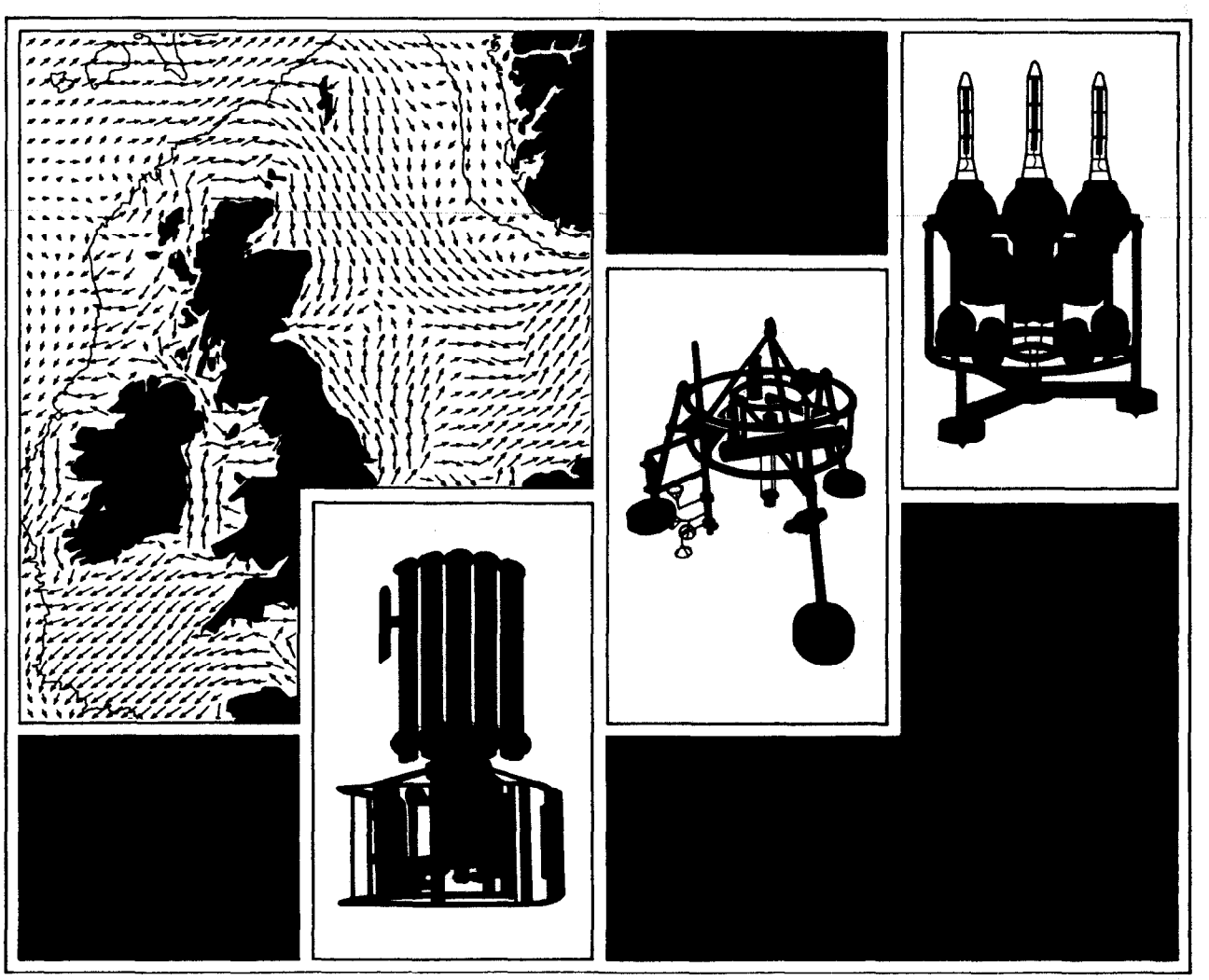
Proudman
Oceanographic
Laboratory

Currents and SPM (suspended particulate material) measurements Holderness, East Coast, England

November - December 1993, October 1994 - February 1995
and October 1995 - January 1996

A Lane
Report No. 45 1997



Natural Environment Research Council

PROUDMAN OCEANOGRAPHIC LABORATORY

Bidston Observatory
Birkenhead, Merseyside, L43 7RA, UK
Tel: 0151 653 8633
Telex: 628591 Ocean B
Fax: 0151 653 6269

Director: Dr. B.S. McCartney

Natural Environment Research Council

PROUDMAN OCEANOGRAPHIC LABORATORY

REPORT No. 45

Currents and SPM (suspended particulate material) measurements Holderness, East Coast, England

November – December 1993, October 1994 – February 1995 and October 1995 – January 1996

Andrew Lane

1997

DOCUMENT DATA SHEET

AUTHOR
LANE, A.

PUBLICATION DATE 1997

TITLE Currents and SPM (suspended particulate material) measurements.
Holderness, East Coast, England.
November – December 1993, October 1995 – February 1995 and October 1995 – January 1996

REFERENCE
Proudman Oceanographic Laboratory, Report No. 45, 50pp.

ABSTRACT

This report describes the data collected by instruments mounted on PMPs (POL monitoring platforms) which were deployed at several sites off the Holderness Coast in the pilot study during winter 1993, and in the surveys during the following two winters 1994-95 and 1995-96. Examples of the graphical output are shown for each of the instruments used.

These surveys form part of the River-Atmosphere-Coastal Study (RACS), which is a component of the Land-Ocean Interaction Study (LOIS), an inter-disciplinary research project of the UK Natural Environment Research Council.

ISSUING ORGANISATION
Proudman Oceanographic Laboratory
Bidston Observatory
Birkenhead, Merseyside L43 7RA
UK

Director: Dr B S McCartney

TELEPHONE:
(0151) 653 8633

FAX:
(0151) 653 6269

TELEX:
628591 OCEAN BG

KEYWORDS
HOLDERNESS NWEURNORW COASTAL EROSION
LOIS CAMELOT SCAWVEX PROMISE
CURRENT MEASUREMENT
SUSPENDED PARTICULATE MATTER MEASUREMENT

CONTRACT

PROJECT MHT–13–6

PRICE £15

CONTENTS

1 INTRODUCTION 7

2 SUMMARY OF DEPLOYMENTS 8
2.1 Deployment inventory 1993 9
2.2 Deployment inventory 1994-95 12
2.3 Deployment inventory 1995-96 17

3 RIG SYSTEM DESCRIPTION 21

4 INSTRUMENTATION 22
4.1 Acoustic Doppler current profiler (ADCP) 22
4.2 S4 electromagnetic current meter 22
4.3 Water-level recorder (WLR) 23
4.4 Environment monitoring package (EMP) 24
4.5 Transmissometer (TR) 24

5 DATA PROCESSING 24
5.1 Raw data transfer 24
5.2 Processing steps 24

6 STATISTICS 25
6.1 Current component statistics 25
6.2 Variance ellipse statistics 25

7 DATA OUTPUT FORMAT 25
7.1 Mooring information 25
7.2 Meter information 26
7.3 Graphical output 26
7.4 Single ADCP bin 26

8 ACKNOWLEDGEMENTS 27

9 REFERENCES 27

10 APPENDIX 29

1 INTRODUCTION

This report describes data collected during the comprehensive measurement programme, carried out as part of the River-Atmosphere-Coastal Study (RACS) of the Land-Ocean Interaction Study (LOIS). Its purpose is to review and catalogue the available data, describe the features of the instrumentation and any difficulties encountered. The data are available via the world-wide web (at `http://www.pol.ac.uk/`) and on the LOIS Project CD-ROM.

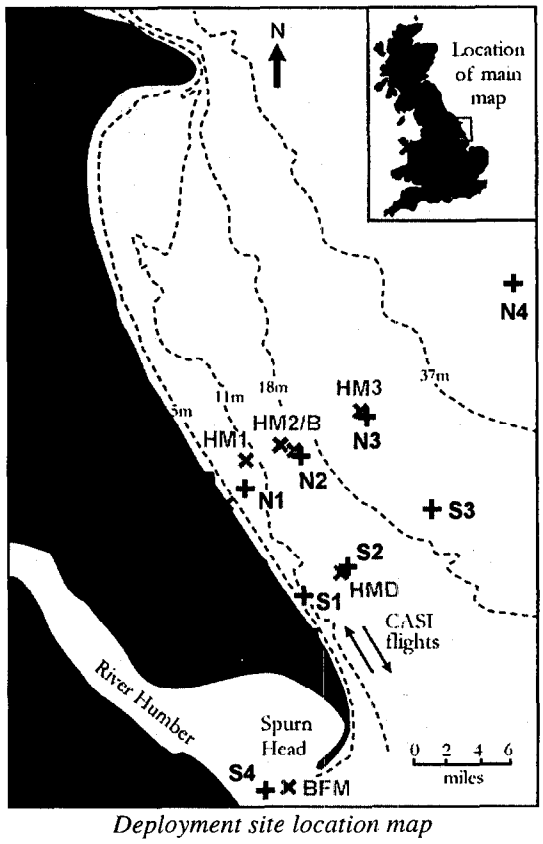
The Holderness coastline consists of rapidly retreating clay cliffs which forms a major source of sediment to the North Sea (Prandle 1994a). The aims of the Holderness experiment are to monitor transport of these sediments away from the coast, and to measure directly contributions to erosion, suspension and transport.

Currents, wave parameters, pressure, temperature and conductivity were recorded, together with transmittance and (optical and acoustic) backscatter which gave indications of suspended particulate material (SPM) concentrations.

Pilot Study 1993

A pilot study was conducted between November and December 1993. Bottom-mounted POL (Proudman Oceanographic Laboratory) monitoring platforms (or PMPs) were deployed and recovered from *RRS Challenger* during cruises CH108A (Howland, 1993), CH108B (Owens, 1993) and CH108C (Millward, 1993).

There were four mooring sites: three on a line perpendicular to the coast – HM1, HM2, HM3; and one at the mouth of the River Humber – BFM. Measurements were also obtained at two sites close to the shore (HMB, HMD) for a short period after the main deployment. Wave data were not collected.



Deployment site location map

Phase one, 1994-95

In the first Holderness experiment (October 1994 – March 1995), two lines of PMP stations were located perpendicular to the coast. The northern line consisted of four moorings (three of which were close to the pilot study PMP positions – N1, N2, N3; one further offshore – N4), and the southern line consisted of three moorings (S1, S2, S3). A PMP was again deployed at the mouth of the River Humber (S4). These instruments were deployed and recovered during cruises CH115 (Prandle, 1994b), CH117, and on board the *FV Janet M.*

Phase two, 1995-96

A second Holderness experiment (October 1995 – January 1996) concentrated on currents and waves at the near-shore sites N1 (two sites – N1A and N1B), N2 (three sites – N2, N2A and N2B), S1 and S2. Instruments were deployed and recovered from the *FV Janet M.*

Other observations concurrent with the 1994–95 and 1995–96 experiments are: OSCR (ocean surface current radar – see Player, 1996a, 1996b) stations located on the coast (blue squares); waverider buoys at sites N1, N2 and N3 (see Wolf, 1996a and 1996b); X-band radar (red cross); regular CASI (compact airborne spectrographic imager) flights along the coast.

Calibrated current data are presented in the form of time series and scatter plots, speed and direction histograms, progressive vector plots, and statistics; all of which give an indication of the content and quality of the data. Other parameters are presented as time series plots.

2 SUMMARY OF DEPLOYMENTS

The following tables show the instruments deployed on the PMPs at each station during the three measurement phases of the Holderness experiment. Instrument codes are:

dp – POL acoustic Doppler current profiler (ADCP)
s4 – s4 current meter
wr/pr – water-level recorder/pressure water-level recorder
em – environment monitoring package (temperature, conductivity, pressure, optical backscatter, pH)
tr – transmissometer

Rig numbers and positions, approximate water depths, deployment/recovery times and deployment lengths are also given. Instrument numbers in square brackets indicate that data were recovered but found to be corrupted. No data were returned where instrument numbers are crossed out.

Listed under the instrument name are the parameters: currents, temperature, conductivity, pressure, SPM concentration, and pH.

Data quality codes are:

Y – good data
S – short time series
U – uncalibrated
N – corrupted/not recorded

2.1 Deployment Inventory 1993

Stn.	Rig No.	Position	Dep. (m)	Deployed	Recovered	No. days	Meter No.				
							dp	s4	wr	em	tr
HM1	609	53 47.70N 0 00.16E	13.0	12/11/93 14:35	23/11/93 13:47	11.0	[0001]	1644	0500	1055	0001
	608			26/11/93 14:11	17/12/93 08:25	20.8	[000x]	1644	~~0500~~	~~1055~~	0001
HM2	610	53 46.50N 0 02.80E	16.0	12/11/93 11:30	23/11/93 09:45	10.9	~~000x~~	1832	1042	1059	0002
	611			26/11/93 10:48	12/12/93 10:45	16.0	[0001]	~~1832~~	1042	–	0002
HM3	612	53 50.60N 0 09.00E	27.0	12/11/93 09:40	22/11/93 16:00	10.3	0010	–	1357	–	–
	613			26/11/93 09:07	08/12/93 15:00	12.2	0010	–	1038	–	–
	614	53 50.70N 0 09.20E	27.0	12/11/93 09:30	22/11/93 14:48	10.2	–	1119	–	–	0004
	615			26/11/93 09:23	08/12/93 15:23	12.3	–	1119	–	–	0004
BFM	617	53 33.57N 0 03.34E	10.0	13/11/93 15:33	22/11/93 11:45	8.8	~~0002~~	1112	1038	1056	0003
	618			27/11/93 15:09	08/12/93 11:44	10.9	–	1112	–	~~1059~~	0003
HMB	637	53 48.05N 0 03.04E	15.0	12/12/93 10:00	17/12/93 13:45	5.2	–	1119	~~0915~~	–	0004
HMD	638	53 43.98N 0 07.60E	14.0	13/12/93 08:45	17/12/93 10:45	4.1	0010	1119	~~1038~~	~~1056~~	0003

Acoustic Doppler Current Profiler (1 MHz)

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Pres.	SPM	pH	Comments
0001	HM1	609	11.0	0.5	600	N	–	–	–	N	–	Data corrupted
	HM2	611	12.8	0.5	600	N	–	–	–	N	–	Data corrupted
0002	BFM	617	–	–	–	N	–	–	–	N	–	No data
0010	HM3	612	10.3	0.5	600	Y	–	–	–	–	–	–
	HM3	613	12.2	0.5	600	Y	–	–	–	–	–	–
	HMD	638	4.1	0.8	600	Y	–	–	–	–	–	Data suspect
000x	HM2	610	–	–	–	N	–	–	–	N	–	No data
	HM1	608	14.8	0.5	600	N	–	–	–	N	–	Data corrupted

InterOcean S4 electromagnetic current meter

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1112	BFM	617	8.8	0.8	1 for 5 min / 2 hr	Y	–	–	–	–	–	14 s slow
	BFM	618	10.8	0.8	1 for 5 min / 2 hr	Y	–	–	–	–	–	4 s slow
	HMD	638	4.0	0.8	1 for 5 min / 2 hr	Y	–	–	–	–	–	–
1119	HM3	614	10.2	0.8	1 for 5 min / 2 hr	Y	–	–	–	–	–	10 s slow
	HM3	615	11.6	0.8	1 for 5 min / 2 hr	Y	–	–	–	–	–	3 s slow
	HMB	637	5.1	0.8	1 for 5 min / hr	Y	–	–	–	–	–	–
1644	HM1	609	10.3	0.8	1 for 5 min / hr	Y	–	–	–	–	–	–
	HM1	608	12.2	0.8	1 for 5 min / hr	Y	–	–	–	–	–	37 s slow
1832	HM2	610	14.8	0.8	1 for 5 min / hr	Y	–	–	–	–	–	–
	HM2	611	–	0.8	1 for 5 min / hr	N	–	–	–	–	–	Data corrupted

Aanderaa water-level recorder

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0500	HM1	609	10.9	0.5	600	–	–	–	Y	–	–	–
	HM1	608	–	–	–	–	–	–	N	–	–	No data
0915	HMB	637	–	–	–	–	N	–	N	–	–	No data
1038	BFM	617	8.8	0.5	600	–	Y	–	Y	–	–	–
	HM3	613	12.2	0.5	600	–	Y	–	Y	–	–	–
	HMD	638	–	–	–	–	N	–	N	–	–	No data
1042	HM2	610	9.9	0.5	600	–	Y	–	Y	–	–	–
	HM2	611	16.0	0.5	600	–	Y	–	Y	–	–	–
1357	HM3	612	2.7	0.5	600	–	S	–	S	–	–	Instrmnt. flooded

WSO environment monitoring package

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1055	HM1	609	10.9	0.5	300	–	Y	Y	Y	U	Y	–
	HM1	608	–	–	–	–	N	N	N	N	N	No data
1056	BFM	617	8.8	0.5	300	–	Y	Y	Y	U	Y	OBS saturated
	HMD	638	–	–	–	–	N	N	N	N	N	No data
1059	HM2	610	10.9	0.5	300	–	Y	Y	Y	U	Y	–
	BFM	618	–	–	–	–	N	N	N	N	N	No data

UCNW transmissometer

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0001	HM1	609	11.9	0.51	60	–	U	U	–	Y	–	10 cm path
	HM1	608	20.8	0.51	60	–	U	U	–	Y	–	10 cm path
0002	HM2	610	10.9	0.51	60	–	U	U	–	Y	–	25 cm path
	HM2	611	16.0	0.51	60	–	U	U	–	Y	–	25 cm path
0003	BFM	617	8.8	0.51	60	–	U	U	–	Y	–	5 cm path
	BFM	618	10.9	0.51	60	–	U	U	–	Y	–	5 cm path
	HMD	638	4.1	0.51	60	–	U	U	–	U	–	25 cm path – no calibrations

2.2 Deployment Inventory 1994-95

Stn.	Rig No.	Position	Dep. (m)	Deployed	Recovered	No. days	Meter No.				
							dp	s4	pr	em	tr
N1	639	53 45.83N 0 00.49E	12.0	09/10/94 08:57	08/11/94 15:20	30.3	0004	2006	0002	–	1686
	647			10/11/94 11:05	14/01/95 10:19	65.0	0010	2006	0002	–	1686
	655			16/01/95 13:45	07/02/95 10:00	21.8	0004	2006	0002	–	1686
N2	640	53 47.53N 0 03.51E	18.0	08/10/94 13:25	08/11/94 14:20	31.0	[0001]	1644	0001	1065	1761
	648			09/11/94 17:18	15/01/95 09:45	66.7	0001	1832	0001	1065	1761
	656			19/01/95 09:34	09/02/95 08:30	21.0	0010	1832	0001	1066	1761
N3	641	53 50.35N 0 09.59E	29.0	07/10/94 08:08	09/11/94 16:24	33.3	0003	1113	[0006]	–	1762
	649			11/11/94 12:58	20/01/95 10:15	69.9	0003	1113	0006	–	1762
	657			20/01/95 16:35	07/02/95 14:10	17.9	[0003]	1265	0008	–	1762
N4	642	53 58.51N 0 25.27E	54.0	07/10/94 19:08	11/11/94 07:06	34.5	0006	–	0007	–	0001
	650			12/11/94 13:50	27/01/95 09:00	75.8	0006	–	0007	–	0001
S1	643	53 42.62N 0 04.69E	14.0	08/10/94 08:23	08/11/94 11:00	31.1	[0008]	2005	0003	–	1683
	651			09/11/94 09:53	14/01/95 09:40	66.0	0008	2005	0003	–	1683
	658			16/01/95 12:30	07/02/95 09:30	21.9	[0009]	2005	0003	–	1683
S2	644	53 43.89N 0 07.49E	18.0	08/10/94 07:40	08/11/94 11:00	31.1	[0002]	1832	0004	1066	1760
	652			09/11/94 09:14	14/01/95 09:40	67.1	0002	1644	0004	1066	1760
	659			19/01/95 08:36	07/02/95 09:30	19.1	0001	1119	0004	1065	1760
S3	645	53 46.75N 0 13.79E	25.0	07/10/94 12:25	09/11/94 11:08	32.9	[0007]	1265	0008	–	0003
	653			10/11/94 17:14	20/01/95 08:50	70.6	0007	1265	0008	–	0003
	660			21/01/95 09:20	07/01/95 11:45	17.1	[0007]	1196	0006	–	0003
S4	646	53 34.08N 0 03.42E	12.0	10/10/94 09:24	07/11/94 09:30	28.0	[0005]	1112	[0005]	–	0002
	654			07/11/94 14:55	unknown	–	0005	1112	0005	–	0002

Acoustic Doppler Current Profiler (1 MHz)

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Pres.	SPM	pH	Comments
0001	N2	640	31.0	0.5	600	N	–	–	–	–	–	Data corrupted
	N2	648	–	–	–	N	–	–	–	–	–	No data
	S2	659	–	–	–	N	–	–	–	–	–	No data
0002	S2	644	31.1	0.5	600	N	–	–	–	–	–	Data corrupted
	S2	652	–	–	–	N	–	–	–	–	–	No data
	N3	657	17.9	0.5	600	N	–	–	–	–	–	Data corrupted
0003	N3	641	–	–	–	N	–	–	–	–	–	No data
	N3	649	–	–	–	N	–	–	–	–	–	No data
0004	N1	639	–	–	–	N	–	–	–	–	–	No data
	N1	655	–	–	–	N	–	–	–	–	–	No data
0005	S4	646	28.0	0.5	600	N	–	–	–	–	–	Data corrupted
	S4	654	–	–	–	N	–	–	–	–	–	No data
0006	N4	642	–	–	–	N	–	–	–	–	–	No data
	N4	650	–	–	–	N	–	–	–	–	–	No data
0007	S3	645	32.9	0.5	600	N	–	–	–	–	–	Data corrupted
	S3	653	–	–	–	N	–	–	–	–	–	No data
	S3	660	1.2	0.5	20	N	–	–	–	–	–	Data corrupted
0008	S1	643	27.7	0.5	600	N	–	–	–	–	–	Data corrupted
	S1	651	–	–	–	N	–	–	–	–	–	No data
0009	S1	658	21.9	0.5	600	N	–	–	–	–	–	Data corrupted
0010	N1	647	–	–	–	N	–	–	–	–	–	No data
	N2	656	–	–	–	N	–	–	–	–	–	No data

InterOcean S4 electromagnetic current meter

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1112	S4	646	27.9	0.8	1 for 1 min / hr	Y	–	–	–	–	–	–
	S4	654	–	–	–	N	–	–	–	–	–	No data
1113	N3	641	29.1	0.8	1 for 1 min / hr	S	–	–	–	–	–	Truncated
	N3	649	–	–	–	N	–	–	–	–	–	No data
1119	S2	659	18.9	0.8	1 for 1 min / hr	S	–	–	–	–	–	18 s slow, trunctd
1196	S3	660	17.0	0.8	1 for 1 min / hr	Y	–	–	–	–	–	–
1265	S3	645	29.1	0.8	1 for 1 min / hr	Y	–	–	–	–	–	–
	S3	653	58.1	0.8	1 for 1 min / 2 hrs	Y	–	–	–	–	–	–
	N3	657	17.8	0.8	1 for 1 min / hr	Y	–	–	–	–	–	29 s slow
1644	N2	640	21.8	0.8	1 for 1 min / ½ hr	S	–	–	–	–	–	Truncated
	S2	652	–	–	–	N	–	–	–	–	–	No data
1832	S2	644	8.1	0.8	1 for 1 min / ½ hr	S	–	–	–	–	–	9 s slow, trunctd
	N2	648	58.2	0.8	1 for 1 min / hr	S	–	–	–	–	–	31 s slow, trunctd
	N2	656	20.8	0.8	1 for 1 min / ½ hr	Y	–	–	–	–	–	–
2005	S1	643	28.9	0.8	1 for 20 mins / hr	Y	–	–	Y	U	–	25 s fast
	S1	651	54.7	0.8	1 for 20 mins / hr	S	–	–	S	U	–	86 s slow, trunctd
	S1	658	20.9	0.8	1 for 20 mins / hr	Y	–	–	Y	U	–	45 s slow
2006	N1	639	29.9	0.8	1 for 20 mins / hr	Y	–	–	Y	U	–	36 s fast
	N1	647	51.1	0.8	1 for 20 mins / hr	Y	–	–	Y	U	–	86 s slow, trunctd
	N1	655	14.1	0.8	1 for 20 mins / hr	S	–	–	S	U	–	Truncated

POL pressure water-level recorder

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0001	N2	640	30.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N2	648	66.5	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N2	656	20.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0002	N1	639	30.1	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N1	647	64.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N1	655	21.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0003	S1	643	31.0	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S1	651	65.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S1	658	21.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0004	S2	644	31.0	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S2	652	66.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S2	659	19.0	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0005	S4	646	34.9	0.35	½, 20 mins / 3 hrs	–	–	–	N	–	–	Data corrupted
	S4	654	84.6	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0006	N3	641	32.9	0.35	½, 20 mins / 3 hrs	–	–	–	N	–	–	Data corrupted
	N3	649	69.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S3	660	16.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0007	N4	642	34.4	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	Chk pwr dns spc!
	N4	650	75.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	Chk pwr dns spc!
0008	S3	645	32.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	S3	653	70.4	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N3	657	17.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–

WSO environment monitoring package

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1065	N2	640	31.0	0.5	600	–	–	Y	Y	U	Y	–
	N2	648	36.0	0.5	900	–	–	Y	Y	U	Y	–
	S2	659	21.0	0.5	600	–	–	Y	Y	U	Y	–
1066	S2	666	31.1	0.5	600	–	Y	Y	Y	U	Y	–
	S2	652	–	–	–	–	N	N	N	N	N	No data
	N2	656	19.0	0.5	600	–	N	Y	Y	U	Y	Tmp'ture suspect

UCNW & WSO transmissometers

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0001	N4	642	34.4	0.51	60	–	–	–	–	Y	–	25 cm path
	N4	650	44.3	0.51	60	–	–	–	–	Y	–	25 cm path
0002	S4	646	10.9	0.51	60	–	–	–	–	Y	–	5 cm path
	S4	654	32.4	0.51	60	–	–	–	–	Y	–	5 cm path
0003	S3	645	32.9	0.51	60	–	–	–	–	Y	–	25 cm path
	S3	653	45.1	0.51	60	–	–	–	–	Y	–	25 cm path
	S3	660	17.1	0.51	60	–	–	–	–	Y	–	25 cm path
1683	S1	643	31.1	0.51	60	–	U	–	–	Y	–	10 cm path
	S1	651	66.0	0.51	60	–	U	–	–	Y	–	10 cm path
	S1	658	21.9	0.51	60	–	U	–	–	Y	–	10 cm path
1686	N1	639	30.3	0.51	60	–	U	–	–	Y	–	10 cm path
	N1	647	42.1	0.51	60	–	U	–	–	Y	–	10 cm path
	N1	655	21.8	0.51	60	–	U	–	–	Y	–	10 cm path
1760	S2	644	31.1	0.51	60	–	U	–	–	Y	–	10 cm path
	S2	652	–	–	–	–	–	–	–	N	–	No data
	S2	659	19.1	0.51	60	–	U	U	–	Y	–	10 cm path
1761	N2	640	31.0	0.51	60	–	U	U	–	Y	–	10 cm path
	N2	648	66.7	0.51	60	–	U	U	–	Y	–	10 cm path
	N2	656	21.0	0.51	60	–	–	–	–	Y	–	10 cm path
1762	N3	641	33.3	0.51	60	–	U	U	–	Y	–	10 cm path
	N3	649	–	0.51	60	–	–	–	–	N	–	No data
	N3	657	17.9	0.51	60	–	U	U	–	Y	–	10 cm path

2.3 Deployment Inventory 1995-96

Stn.	Rig No.	Position	Dep. (m)	Deployed	Recovered	No. days	Meter No.				
							dp	s4	pr	em	tr
N1A	712	53 46.06N 0 00.47E	12.0	10/10/95 12:32	21/10/95 10:55	10.9	0008/1	–	0003/6	–	1762
	714	53 46.04N 0 00.50E	14.0	21/10/95 11:55	31/10/95 17:45	10.2	0005	–	–	–	–
	718	53 45.93N 0 00.75E	14.0	31/10/95 17:42	20/11/95 13:15	19.9	0002	2006	0001	–	1762
	723			20/11/95 14:07	08/12/95 11:50	17.9	0005	2006	0001	–	1762
	726	53 45.89N 0 00.78E	13.0	10/12/95 12:20	16/01/96 12:09	37.0	0005	2006	0003	–	1762
N1B	715	53 45.94N 0 00.73E	14.0	21/10/95 10:49	31/10/95 17:00	10.3	0006	–	–	–	–
	730	53 46.05N 0 00.59E	14.0	31/10/95 16:16	08/12/95 11:33	37.8	–	1196	–	–	–
	727	53 45.94N 0 00.75E	13.0	10/12/95 12:10	16/01/96 12:40	37.0	0004	1119	–	–	–
N2	713	53 47.59N 0 03.53E	18.0	21/10/95 12:52	31/10/95 15:27	10.1	0003	–	–	–	–
N2A	711	53 47.64N 0 03.53E	17.0	10/10/95 11:46	11/10/95 11:28	1.0	0002/4	–	–	–	–
	716	53 47.60N 0 03.49E	19.0	31/10/95 15:27	20/11/95 15:30	20.0	0001	2005	0008	–	0001
	721			20/11/95 15:45	08/12/95 10:35	17.8	0001	2005	0008	–	0001
	724	53 47.64N 0 03.50E	18.0	10/12/95 13:55	16/01/96 13:20	37.0	0006	2005	0007	–	0001
N2B	717	53 47.48N 0 03.59E	19.0	31/10/95 14:05	20/11/95 14:40	20.0	0008	1119	–	–	–
	722			20/11/95 15:08	08/12/95 10:00	17.8	0006	1119	–	–	–
	725	53 47.52N 0 03.51E	18.0	10/12/95 13:15	17/01/96 11:20	37.0	0007	[1265]	–	–	–
S1	720	53 42.71N 0 04.55E	15.0	01/11/95 14:53	08/12/95 12:45	36.9	0004	1644	0004	–	1683
	729	53 42.82N 0 04.63E	14.0	09/12/95 12:50	17/01/96 12:45	39.0	0002	1832	0002	1057	1683
S2	719	53 43.92N 0 07.47E	18.0	01/11/95 16:25	08/12/95 13:20	36.9	0007	1832	0007	–	–
	728	53 43.87N 0 07.66E	18.0	09/12/95 12:25	17/01/96 12:20	39.0	0008	1196	0006	1059	1686

Acoustic Doppler Current Profiler (1 MHz)

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Pres.	SPM	pH	Comments
0001	N1A	712	0.1	0.5	600	Y	–	–	–	U	–	Test deployment
	N2A	716	20.0	0.5	600	Y	–	–	–	U	–	–
	N2A	721	13.1	0.5	600	Y	–	–	–	U	–	–
0002	N2A	711	1.0	0.5	600	Y	–	–	–	U	–	Test deployment
	N1A	718	19.8	0.5	600	Y	–	–	–	U	–	–
	S1	729	30.5	0.5	600	Y	–	–	–	U	–	–
0003	N2	713	10.0	0.5	600	Y	–	–	–	U	–	–
0004	N2A	711	0.1	0.5	600	Y	–	–	–	U	–	Test deployment
	S1	720	35.4	0.5	600	Y	–	–	–	U	–	Modultns bin 1–7
	N1B	727	34.8	0.5	600	Y	–	–	–	U	–	Modultns bin 1–5
0005	N1A	714	10.2	0.5	600	Y	–	–	–	U	–	–
	N1A	723	17.9	0.5	600	Y	–	–	–	U	–	–
	N1A	726	1.0	0.5	600	S	–	–	–	U	–	Truncated
0006	N1B	715	9.8	0.5	600	Y	–	–	–	U	–	Test deployment
	N2B	722	17.4	0.5	600	Y	–	–	–	U	–	–
	N2A	724	33.1	0.5	600	Y	–	–	–	U	–	–
0007	S2	719	34.2	0.5	600	Y	–	–	–	U	–	Modultns bin 1–7
	N2A	725	15.0	0.5	600	Y	–	–	–	U	–	Modultns bin 1–2
0008	N1A	712	1.0 and 9.9	0.5	600	Y	–	–	–	U	–	Incl. test dplymnt
	N1B	717	14.7	0.5	600	S	–	–	–	U	–	Intrmittent, trnctd
	S2	728	26.4	0.5	600	Y	–	–	–	U	–	–

InterOcean S4 electromagnetic current meter

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1119	N2B	717	20.0	0.71	1 for 1 min / hr	S	–	–	–	–	–	–
	N2B	722	8.6	0.71	1 for 1 min / hr	S	–	–	–	–	–	Truncated
	N1B	727	28.8	0.71	1 for 1 min / hr	S	–	–	–	–	–	Truncated
1196	N1B	730	28.0	0.71	1 for 1 min / hr	S	–	–	–	–	–	Truncated
	S2	728	28.2	0.71	1 for 1 min / hr	S	–	–	–	–	–	Truncated
1265	N2B	725	28.7	0.71	1 for 1 min / hr	N	–	–	–	–	–	Data corrupted
1644	S1	720	29.3	0.71	1 for 1 min / hr	S	–	–	–	–	–	Truncated
1832	S2	719	28.9	0.71	1 for 1 min / ½ hr	Y	–	–	–	–	–	Intrmittent, trnctd
	S1	729	29.1	0.71	1 for 1 min / ½ hr	Y	–	–	–	–	–	Truncated
2005	N2A	716	20.0	0.71	1 for 20 mins / hr	Y	–	–	Y	U	–	Dep underesitmtd
	N2A	721	17.8	0.71	1 for 20 mins / hr	Y	–	–	Y	U	–	Dep underesitmtd
	N2A	724	21.8	0.71	1 for 20 mins / hr	Y	–	–	N	U	–	Depths corrupted
2006	N1A	718	19.8	0.71	1 for 20 mins / hr	Y	–	–	Y	U	–	–
	N1A	723	17.9	0.71	1 for 20 mins / hr	Y	–	–	Y	U	–	–
	N1A	726	18.5	0.71	1 for 20 mins / hr	S	–	–	S	U	–	Truncated

POL pressure water-level recorder

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0001	N1A	718	19.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N1A	723	17.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0002	S1	729	38.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0003	N1A	712	—	—	—	—	—	—	N	—	—	No data
	N1A	726	36.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0004	S1	720	2.3	0.35	1, 40 mins / 3 hrs	–	–	–	S	–	–	Truncated
0006	N1A	712	—	—	—	—	—	—	N	—	—	No data
	S2	728	38.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0007	S2	719	36.8	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N2A	724	36.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
0008	N2A	716	19.9	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–
	N2A	721	17.6	0.35	½, 20 mins / 3 hrs	–	–	–	Y	–	–	–

WSO environment monitoring package

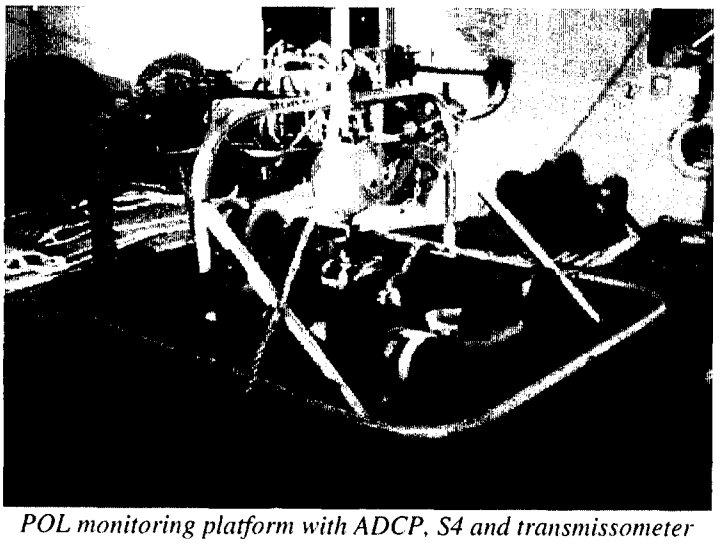
Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
1057	S1	729	39.0	0.5	600	–	Y	Y	Y	U	Y	pH suspect
1059	S2	728	34.6	0.5	600	–	S	S	S	U	S	Truncated

UCNW transmissometer

Mtr. No.	Stn.	Rig No.	Data length (days)	Ht. (m)	Recording interval (s)	Crnt.	Tmp.	Cnd.	Prs.	SPM	pH	Comments
0001	N2A	716	20.0	0.51	60	–	–	–	–	U	–	10 cm path
	N2A	721	17.8	0.51	60	–	–	–	–	U	–	10 cm path
	N2A	724	37.0	0.51	60	–	–	–	–	U	–	10 cm path
1683	S1	720	36.9	0.51	60	–	–	–	–	U	–	5 cm path
	S1	729	39.0	0.51	60	–	–	–	–	U	–	5 cm path
1686	S2	728	39.0	0.51	60	–	–	–	–	U	–	10 cm path
1762	N1A	712	...	...	...	...	...	...	...	N	...	No data
	N1A	718	19.8	0.51	60	–	–	–	–	U	–	5 cm path
	N1A	723	17.9	0.51	60	–	–	–	–	U	–	5 cm path
	N1A	726	37.0	0.51	60	–	–	–	–	U	–	5 cm path

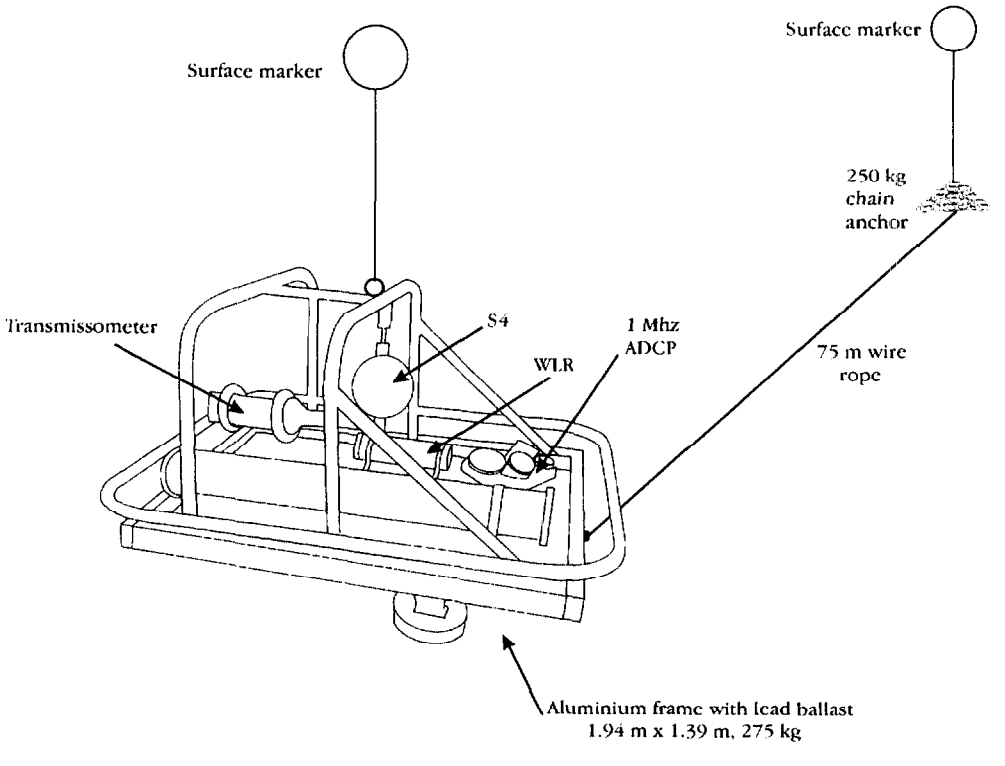
3 RIG SYSTEM DESCRIPTION

POL monitoring platforms (PMPs) were developed to accommodate several instruments at once. It consists of a ballasted light-weight low-profile frame, onto which an acoustic release and buoyancy tanks are attached.



POL monitoring platform with ADCP, S4 and transmissometer

These frames were positioned on the sea-bed with a surface marker buoy. On recovery, the frame separated from the ballast, and rose to the surface. During this experiment, the ballast was attached by a nylon spooler line to the PMP frame, which enabled the entire rig to be recovered.



PMP frame and mooring

4 INSTRUMENTATION

4.1 Acoustic Doppler current profiler (POL 1 MHz)

This instrument measured vertical profiles of current in bins in the water column. Short acoustic pulses, lasting a few thousandths of a second, at fixed frequency, are emitted by two transducers oriented at right angles to each other, and at 30° to the vertical. Some of this signal is back-scattered by small particles such as sediment, which is assumed to move with the water. The components of velocity in the direction of each transducer can be calculated from the Doppler shifted frequencies of the returned signals and its location in the water column is determined by the timing of the returned signals (range gating).

The POL-built 1 MHz ADCP has a range of approximately 30 m, and was set up to measure currents in 0.5 m bins. Bins closest to the transducers may record erroneous data due to the time taken for transients to decay, whereas data in bins near to the sea surface may be contaminated because of side-lobe interference. Hence accurate data are usually limited to bins between 15% of depth below the sea surface, and approximately 10% of depth from the bed. Occasionally, bin heights are greater than the nominal water depth given, therefore data should be used with care.

In these deployments, the ADCP recorded the variances and back-scatter signal strengths in addition to the Doppler frequency shift in each beam.

Problems encountered with this instrument, especially during the first Holderness Experiment, severely limited the usefulness of the data. Surges in battery power output caused the mean signal to be modulated in the bins closest to the transducers, however this behaviour settles after a few days. A consequence of this is that the data record terminates early when the battery is exhausted. Occasionally, the exact frequency of the emitted pings is not accurately known, causing the currents to be offset from zero.

Specification

Speed:
Range, 0 to 350 cm s^{-1}
Accuracy, ± 4 cm s^{-1}

Direction:
0 to 360°

Tilt:
Two tilts measured at 90° to each other

Sample period, 10 minutes
Number of bins, dependent on depth
Number of pings in ensemble, dependent on depth

Unless otherwise stated, first bin height is 2.5 m, bin separation is 0.5 m

4.2 S4 electromagnetic current meter

The InterOcean S4 current meter is housed in a self-contained 0.25 m diameter sphere. Operating in burst mode, this instrument sampled every half second and records vectors averaged over one second. On the S4DW (S4 2000 series), wave parameters (including significant wave height, H_S, zero up-crossing period, T_Z, and wave spectra) were also derived from simultaneously recorded pressure water-level data.

There is some concern over the positioning of this instrument on the PMP frame. It is not certain as to the implications of the placing this instrument close to the sides of the frame. Flow disturbances during times of high current speeds may have an appreciable effect on the accuracy of the instrument.

Specification

Speed:
Range, 0 to 350 cm s^{-1}
Resolution, 0.2 cm s^{-1} (standard)
Accuracy, 2% of reading, ± 1 cm s^{-1}

Direction:
Flux gate compass, 0 to 360°
Resolution, 0.5°
Accuracy, ±2° within tilt angles of 5°
Tilt, ±4° for tilt angles between 15° and 25°

Tilt:
Two tilts measured at 90° to each other, angle range, ±45°
Resolution, 0.06°
Accuracy, (angle) ±0.25°, (speed correction) ±1% of reading at 45° tilt
N.B. Speeds and directions recorded already account for tilts.

Depth (S4DW):
Semiconductor strain gauge, range, 0 to 70 m
Resolution, (high-res bit) 4 mm
Accuracy, ±0.15% full scale
Response time (63%), 60 ms

Optical backscatter (S4DW):
Resolution, (high-res bit) 0.01 FTU (Formazine transmission units)

Sample period, 1 second on for 1 minute every hour (sampling intervals vary according to deployment). S4DW: 1 second on for 20 minutes every hour.

4.3 Water-level recorder

During the pilot study (1993), hydrostatic pressures were measured by Aanderaa water-level recorders (WLR). These high precision instruments have a standard range of 0 to 27.2 bars corresponding to a sensor range of up to 270 m. An integration period of 40 s reduces the effects of waves. Water temperatures are also measured by a thermistor located on the top of the meter.

In the Holderness Experiments (1994-95 and 1995-96), water levels were obtained by (experimental) POL-built pressure water-level recorders (PWR). Depths are recorded every half second for 20 minutes every three hours. From these data, integrated parameters such as significant wave height, H_S, zero up-crossing period, T_Z, and wave spectra can be calculated.

Specification

Pressure:
Range, 0.0 to 27.2 bars (0 to 400 PSI)
Accuracy, 0.01% of pressure

Temperature:
Range, 0.0 to 30.0°C
Accuracy, ±0.03°C

Sample period, 10 minutes

4.4 Environment monitoring package

The WSO environment monitoring package (EMP2000) was set up to record the following parameters at 10 minute intervals: pressure, temperature, conductivity, dissolved oxygen, pH, optical back-scatter and salinity.

4.5 Transmissometer

Two versions of transmissometer were used: UCNW-built tranmissometer, WSO TB-2 transmissometer. These instruments were configured to record the beam transmission in a water path of fixed length at one minute intervals. After calibration against filtered water samples, values of suspended particulate material concentration (in mg l^{-1}) can be calculated (Lowry, 1995a and 1995b).

Note: Transmissometers deployed during 1995–96 are without direct calibrations and secondary calibrations are not available, even though a SeaTech transmissometer was used for comparison during deployment/recovery. The last known calibrations (from a previous deployment) have been used to convert the raw data values to beam attenuations (in m^{-1}).

5 DATA PROCESSING

5.1 Raw data transfer

The raw data are downloaded to a portable computer from the retrieved instruments whilst on board the deploying vessel. At POL, these data files are backed-up onto 3½" optical disk and then transferred, via a PC on the local area network, to a UNIX workstation for subsequent processing and storage.

5.2 Processing steps

Separate processing packages (one for each type of instrument) were developed in the FORTRAN programming language. The programs convert the raw data (often given in counts) to engineering units. The mooring positions, calibration coefficients, deployment and data start/end times are stored in individual control files, one for each associated data file.

A suite of PV-WAVE routines enabled the visualisation of the data, the output from which are included in this report. The quality of the data can be inspected and when necessary, the calibration stage repeated after editing or flagging the raw data.

Many of the FORTRAN routines used in the current meter processing packages were from Knight (1995). Software to extract wave parameters from the S4DW and PWR meters were originally written by Wolf (1996a).

6 STATISTICS

The following statistics (relevant to currents) were produced in order to assess the quality of the current components and current ellipse data. Where relevant, the burst averaged data were used.

6.1 Current component statistics

Mean, variance and standard deviations were computed from the east and north components of velocities. The mean vector speeds and directions are derived from these.

The output includes the maximum and minimum ten northings and eastings, and the highest one hundred speeds.

6.2 Variance ellipse statistics

The maximum variance, minimum variance, their sum and ratio are calculated for the current ellipse. If the value of this ratio is close to one, the currents have no preferred direction. Conversely, a value close to zero indicates rectilinear flow. Directions associated with the above variances are also found (in the range $-180°$ to $+180°$).

Additionally, the average directions for each half of the ellipse are calculated. If these differ by 180°, then the current ellipse is symmetrical.

7 DATA OUTPUT FORMAT

Speeds and velocities are given in m s^{-1}, directions in degrees from true north, and time in GMT. Results are ordered by mooring site (e.g. HM1–3, BFM, HMB/D). Each data result consists of: mooring information, instrument information, graphical output and statistics.

7.1 Mooring information

Each mooring description consists of the following

Position Latitude	: *Latitude of deployment*
Position Longitude	: *Longitude of deployment*
Water depth	: *Depth measured by ship's echo sounder*
Deployed on cruise	: *Cruise identifier or ship name*
Site identification	: *Additional site identifier*
Magnetic variation	: *Obtained from Admiralty Chart*
Rig deployed on	: *Time at which frame reaches bottom*
Rig recovered on	: *Time at which release fired on rig*
Period of deployment	: *Total time of deployment*
Comments	: *Other details regarding mooring*

7.2 Meter information Each instrument description consists of the following

Rig number	: *Unique POL mooring reference number*
Recording interval	: *Sampling interval in seconds*
Meter height from bottom	: *Height in metres*
Meter type	: **ADCP** *for POL ADCP,* **S4/S4DW** *for S4 current meter,* **WLR** (Aanderaa)/ **PWR** (POL) *for water-level recorder,* **EMP** *for WSO environment monitoring package,* **TR** *for transmissometer*
Meter started	: *Date and time*
Meter stopped	: *Date and time*
Period switched on	: *Total time meter switched on*
Period of good data	: *Total time good data returned*
Total number of scans	: *Number of scans of good data*
Timing error	: *Error in seconds*
Comments	: *Other details regarding instrument*

7.3 Graphical output

The types of graphical output vary according to the data that is returned by an instrument. Listed after each description are the instrument types to which they pertain.

1. Time series of north and east components of velocity (for average of each burst). These show the spring-neap cycles and semi-diurnal nature of tidal currents. [**ADCP** (8 bins per plot); **S4/S4DW** (single)]
2. Scatter diagrams of north against east components of velocity, showing direction and magnitude of currents. This plot provides a visual check on data quality, particularly of directions, and possible problems at low speeds. [**ADCP** (8 bins per plot); **S4/S4DW** (single)]
3. Histograms of speeds and directions, indicating distribution of speeds and directions throught the deployment period. [**S4/S4DW**]
4. Eulerian progressive vector plot. The nature of the residual flow is emphasised, although the semi-diurnal tidal pattern is still apparent. [**ADCP, S4/S4DW** (single)]
5. Pressure and temperature time series plots. [**WLR, EMP, S4DW**]
6. Time series of conductivity, pH and optical backscatter. [**EMP**]
7. Backscatter signal strength time series. [**ADCP**]
8. Beam attenutation and sediment concentration times series. [**TR**]
9. Time series of significant wave height, H_S, zero up-crossing period, T_Z, power density spectrum. [**S4DW/PWR**]

Graphical output for a selection of instruments are given in the Appendix.

Output for all instruments deployed during the pilot study and phase one surveys are given in POL Internal Document No. 122 (Lane, 1997a), and the phase two survey in POL Internal Document No. 123 (Lane, 1997b).

7.4 Single ADCP bin

In addition to the multiple time series and scatter diagrams that are produced for ADCPs, single plots are also produced for the bin closest to 0.4 times the water depth. This is where it is expected that conditions are most representative of the water column (Prandle, 1982).

8 ACKNOWLEDGEMENTS

The author is grateful to the staff at POL who set up, deployed and recovered the instruments (A. D. Banaszek, D. Flatt, A. J. Harrison). Thanks to those who offered advice at all stages of the data processing (R. K. Lowry, D. Prandle, J. Wolf).

The Holderness Experiment contributes to the following EU RTD projects:
SCAWVEX Surface Currents and Wave Variability Experiment (MAS2 CT94 0103)
PROMISE Pre-operational modelling in the Seas of Europe (MAS3 CT95 0025)

This document is LOIS publication No. 329.

9 REFERENCES

HOWLAND, R. (1993) *RRS Challenger Cruise 108A, 8–24 November 1993 – Humber plume and east coast.* Plymouth Marine Laboratory, Cruise Report. 21pp & figs.

KNIGHT, P. J. (1995) *Time series data processing manual, Version 2.0 – January 1995,* Proudman Oceanographic Laboratory, Internal Document No. 77. 55pp.

LANE, A. (1997a) *Currents and SPM (suspended particulate material) measurements. Holderness, East Coast, England. November – December 1993, October 1994 – February 1995,* Proudman Oceanographic Laboratory, Internal Document No. 122. 447pp. LOIS publication No. 327.

LANE, A. (1997b) *Currents and SPM (suspended particulate material) measurements. Holderness, East Coast, England. October 1995 – January 1996,* Proudman Oceanographic Laboratory, Internal Document No. 123. 355pp. LOIS publication No. 328.

LOWRY, R. K. (1995a) *Holderness Experiment 1993 Deployment. Self logging transmissometer – calibration report.* British Oceanographic Data Centre, Internal Report. 10pp.

LOWRY, R. K. (1995b) *Holderness Experiment 1994–5 Deployment. Self logging transmissometer – calibration report.* British Oceanographic Data Centre, Internal Report. 23pp.

MILLWARD, G. E. (1993) *RRS Challenger Cruise 108C, 11–23 December 1993 – Humber-Tweed coastal zone.* Plymouth Marine Laboratory, Cruise Report. 30pp.

OWENS N. J. P. (1993) *RRS Challenger Cruise 108B, 25 November – 10 December 1993. Plymouth Marine Laboratory, Cruise Report.* 27pp & figs.

PLAYER, R. J. (1996a) *HF Radar (OSCR) surface current measurements, Holderness, England. September 1994 – March 1995.* Proudman Oceanographic Laboratory, Internal Document No. 92. LOIS Publication No. 60. 54pp.

PLAYER, R. J. (1996b) *HF Radar (OSCR) surface current measurements, Holderness, England. November 1995 – January 1996.* Proudman Oceanographic Laboratory, Internal Document No. 93. LOIS Publication No. 61. 23pp.

PRANDLE, D. (1982) *The vertical structure of tidal currents and other oscillatory flows.* Continental Shelf Research **1**(2), 191–207.

PRANDLE, D. (1994a) *Holderness experiment – the observational programme.* LOIS issue No. 2. 12pp. Natural Environment Research Council.

PRANDLE, D. (1994b) *RRS Challenger Cruise 115A, 4–17 October 1994 – The Humber-Wash estuarine plume system, The Holderness coast, The Humber-Tweed coastal strip.* Proudman Oceanographic Laboratory, Cruise Report No. 19. 16pp & figs.

PRANDLE, D., G. BALLARD, A. BANASZEK, P. BELL, D. FLATT, P. HARDCASTLE, A. HARRISON, J. HUMPHERY, G. HOLDAWAY, A. LANE, R. PLAYER, J. WILLIAMS, J. WOLF (1996) *The Holderness Coastal Experiment '93 – '96.* Proudman Oceanographic Laboratory, Report No. 44. 48pp.

WOLF, J. (1996a) *The Holderness Project: wave data.* Proudman Oceanographic Laboratory, Internal Document No. 89. 61pp.

WOLF, J. (1996b) *The intercomparison of wave data from moored instruments.* Proudman Oceanographic Laboratory, Internal Document No. 103. 37pp.

10 APPENDIX

The following pages show examples of the graphical output available for each instrument type. POL Internal Document Nos. 122 and 123 (Lane, 1997a and 1997b) and the Internet site `http://www.pol.ac.uk/` contain output for all instruments deployed for which data are available.

Instrument	*No.*	*Site/Mooring No.*	
PWR	**0001**	**N2/640**	Time series plots for: depth, H_S, T_Z, power density spectrum
UCNW TR	**0001**	**N4/642**	Time series plots for: beam attenuation, SPM concentration
S4DW	**2005**	**S1/643**	Time series plots for: velocity components, optical backscatter, depth, H_S, T_Z, power density spectrum Scatter plot, histograms for speeds and directions Statistics for: speeds, variance ellipse
ADCP	**0001**	**N2A/716**	Time series plots (bins 1–8 only) for: velocity components, acoustic backscatter Scatter plots (bins 1–8 only) Variance ellipse statistics
EMP	**1059**	**S2/728**	Time series plots for: pressure, temperature, conductivity, optical backscatter, pH

Mooring information for 00640

Position Latitude	: 53 47.53N
Position Longitude	: 0 03.51E
Water depth	: 18.0 m
Deployed on cruise	: CH115A
Site identification	: N2
Magnetic variation	: 4.0 degrees west
Mooring deployed on	: 08-OCT-1994 13:25:00
Mooring recovered on	: 08-NOV-1994 14:20:00
Period of deployment	: 31.0 days
Comments	: None

Meter information for 0001

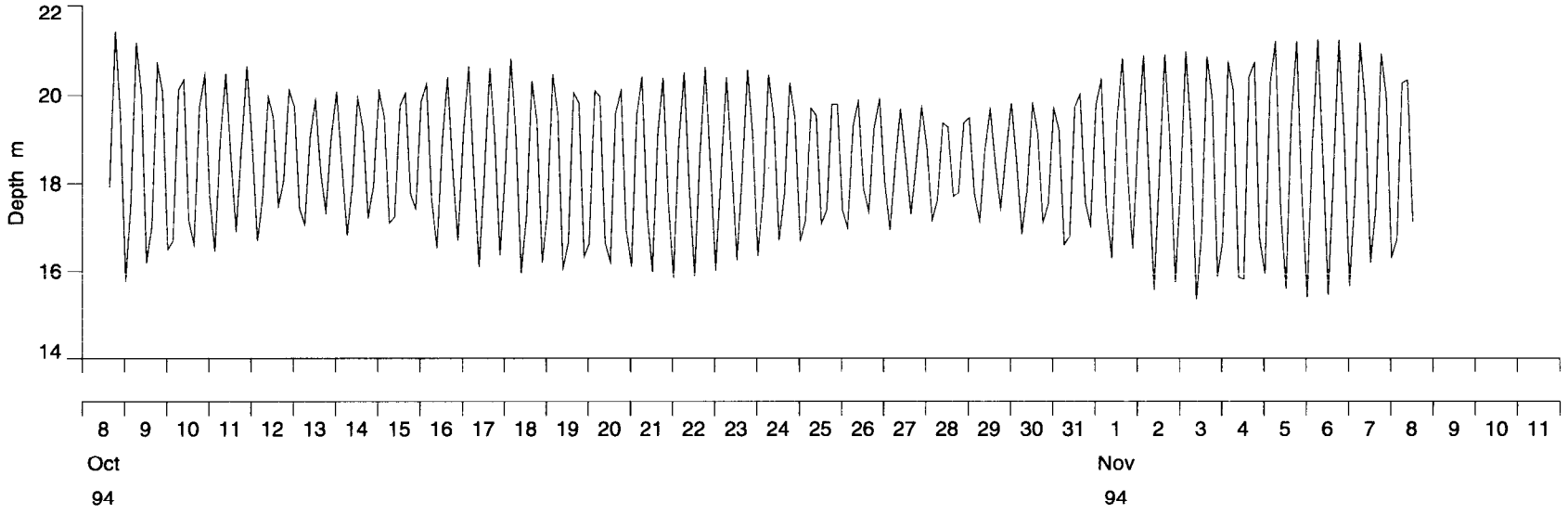
Mooring number	: 00640
Recording interval	: 0.5 s, on for 20 minutes every hour
Meter height from bottom	: 0.35 m
Meter type	: PWR
Meter started	: 08-OCT-1994 15:30:23
Meter stopped	: 08-NOV-1994 12:50:31
Period switched on	: 30.9 days
Period of good data	: 30.9 days, 3.4 days excluding sleep periods
Number of scans	: 595200
Timing error	: None
Comments	: None

DEPTH TIME SERIES PLOT

Meter no. 0001 Rig no. 00640 Depth of water 18.0 m

Start/End 1994/10/08 AT 15:30:23 1994/11/08 AT 12:50:31

Position 53 47.53N 0 03.51E Meter Height 0.35 m

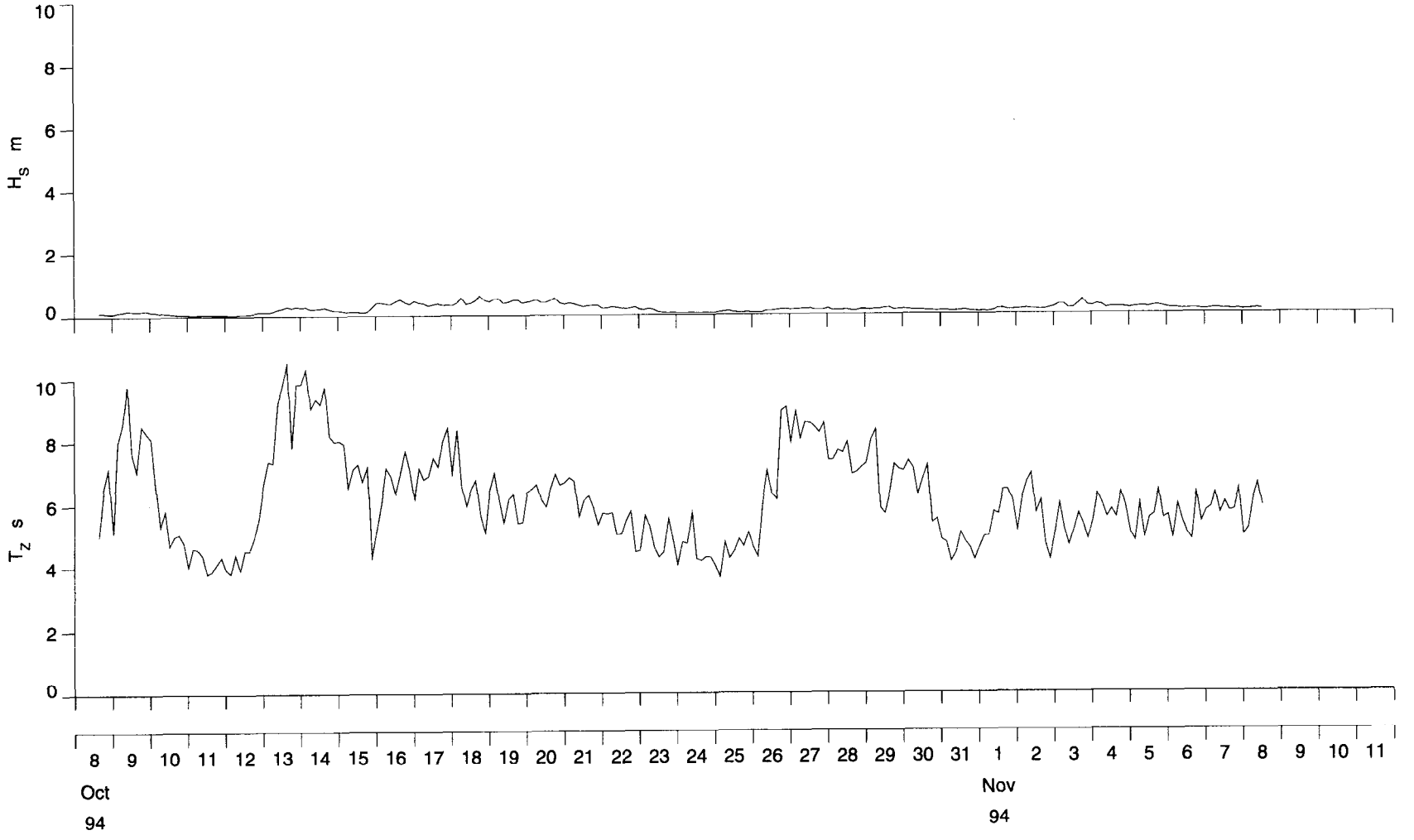


SIGNIFICANT WAVE HEIGHT AND ZERO UP-CROSSING PERIOD TIME SERIES PLOTS

Meter no. 0001 Rig no. 00640 Depth of water 18.0 m

Start/End 1994/10/08 AT 15:30:23 1994/11/08 AT 12:50:31

Position 53 47.53N 0 03.51E Meter Height 0.35 m

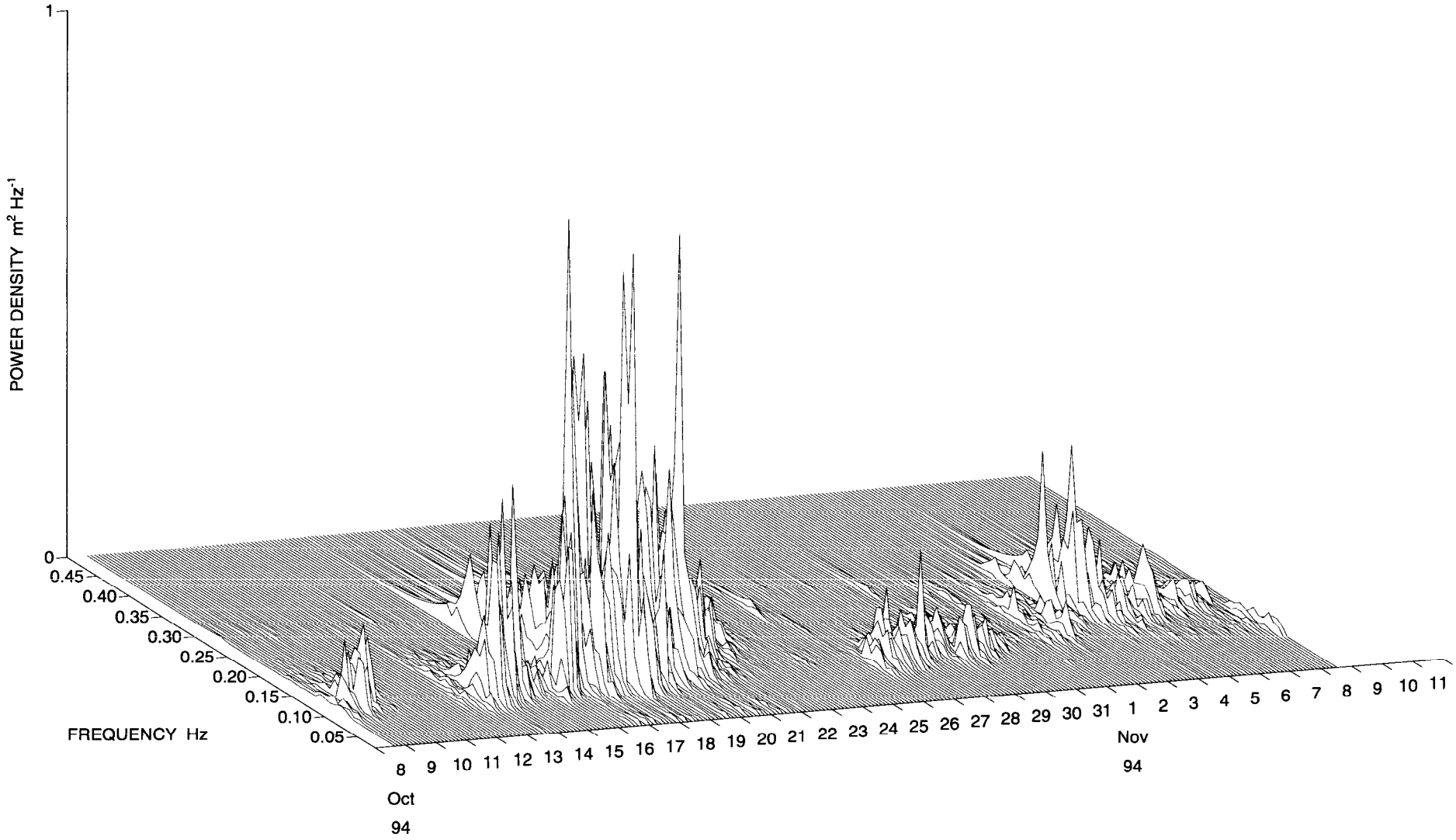


POWER DENSITY SPECTRA

Meter no. 0001 Rig no. 00640 Depth of water 18.0 m

Start/End 1994/10/08 AT 15:30:23 1994/11/08 AT 12:50:31

Position 53 47.53N 0 03.51E Meter Height 0.35 m



Mooring information for 00642

Position Latitude	: 53 58.51N
Position Longitude	: 0 25.27E
Water depth	: 54.0 m
Deployed on cruise	: CH115A
Site identification	: N4
Magnetic variation	: 4.0 degrees west
Mooring deployed on	: 07-OCT-1994 19:01:00
Mooring recovered on	: 11-NOV-1994 07:06:00
Period of deployment	: 34.5 days
Comments	: None

Meter information for 0001

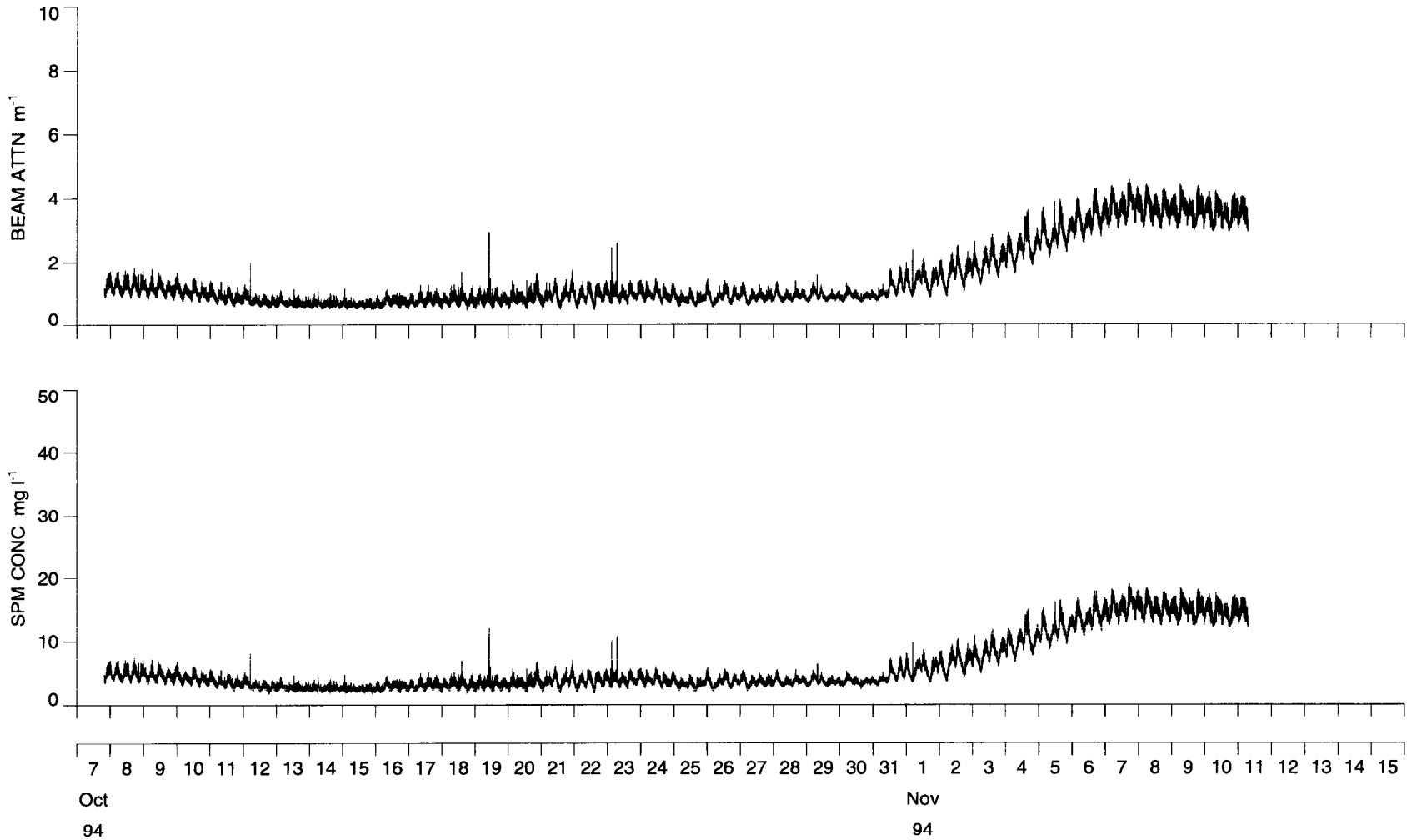
Mooring number	: 00642
Recording interval	: 60 s
Meter height from bottom	: 0.51 m
Meter type	: UCNW TR
Meter started	: 07-OCT-1994 19:46:00
Meter stopped	: 11-NOV-1994 07:14:00
Period switched on	: 34.4 days
Period of good data	: 34.4 days
Number of scans	: 49648
Timing error	: None
Comments	: Path length 25 cm

BEAM ATTENUATION AND SPM CONCENTRATION TIME SERIES PLOTS

Meter no. 0001 Rig no. 00642 Depth of water 54.0 m

Start/End 1994/10/07 AT 19:46:00 1994/11/11 AT 07:14:00

Position 53 58.51N 0 25.27E Meter Height 0.51 m



Mooring information for 00643

Position Latitude	: 53 42.62N
Position Longitude	: 0 04.69E
Water depth	: 14.0 m
Deployed on cruise	: CH115A
Site identification	: S1
Magnetic variation	: 4.0 degrees west
Mooring deployed on	: 08-OCT-1994 08:23:00
Mooring recovered on	: 08-NOV-1994 11:00:00
Period of deployment	: 31.1 days
Comments	: None

Meter information for 2005

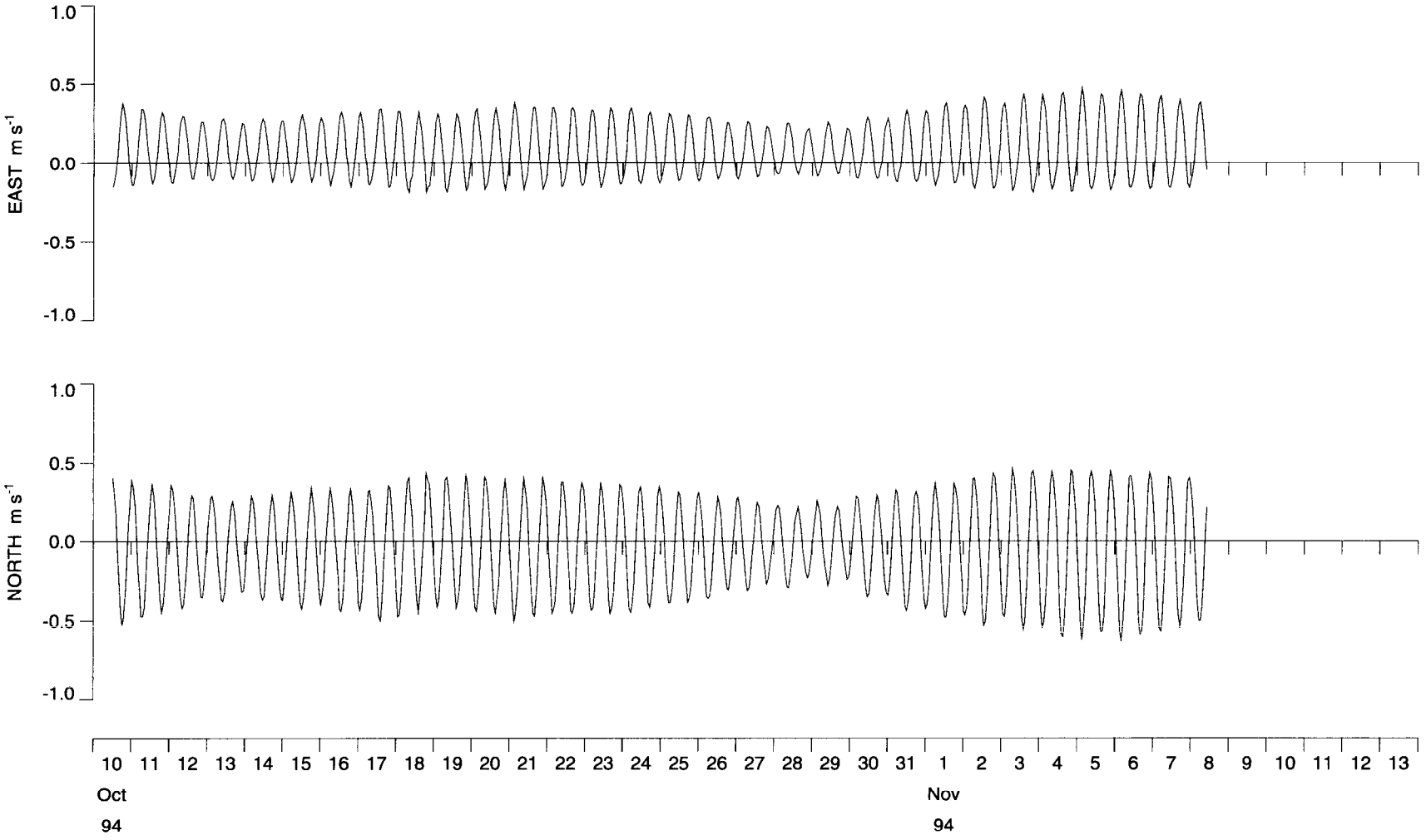
Mooring number	: 00643
Recording interval	: 1 s, on for 20 minutes every hour
Meter height from bottom	: 0.8 m
Meter type	: S4DW
Meter started	: 10-OCT-1994 12:00:00
Meter stopped	: 08-NOV-1994 13:20:00
Period switched on	: 29.1 days
Period of good data	: 28.9 days, 9.7 days excluding sleep periods
Number of scans	: 834000
Timing error	: 25 s fast
Comments	: None

VELOCITY COMPONENT TIME SERIES PLOT

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m

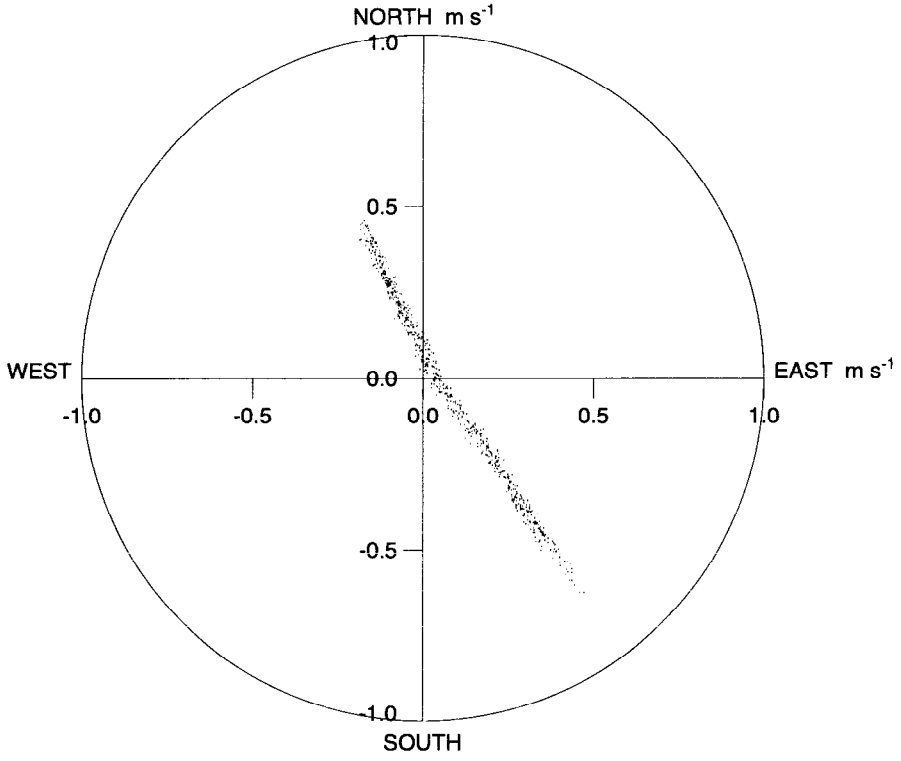


SCATTER PLOT

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m

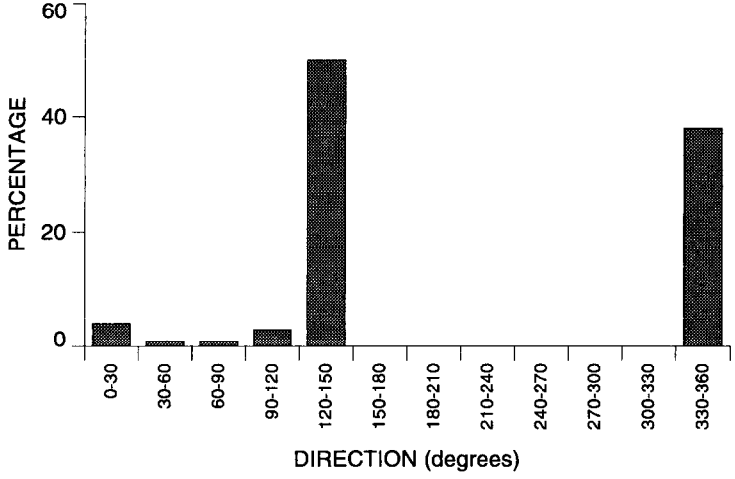


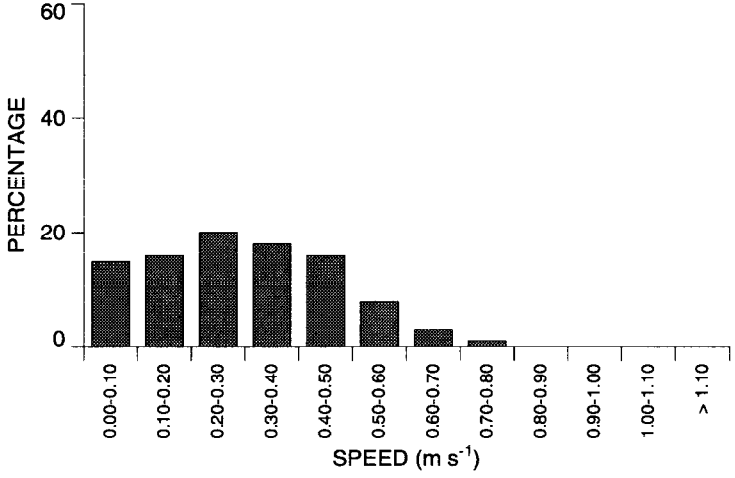
HISTOGRAMS FOR SPEEDS AND DIRECTIONS

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m



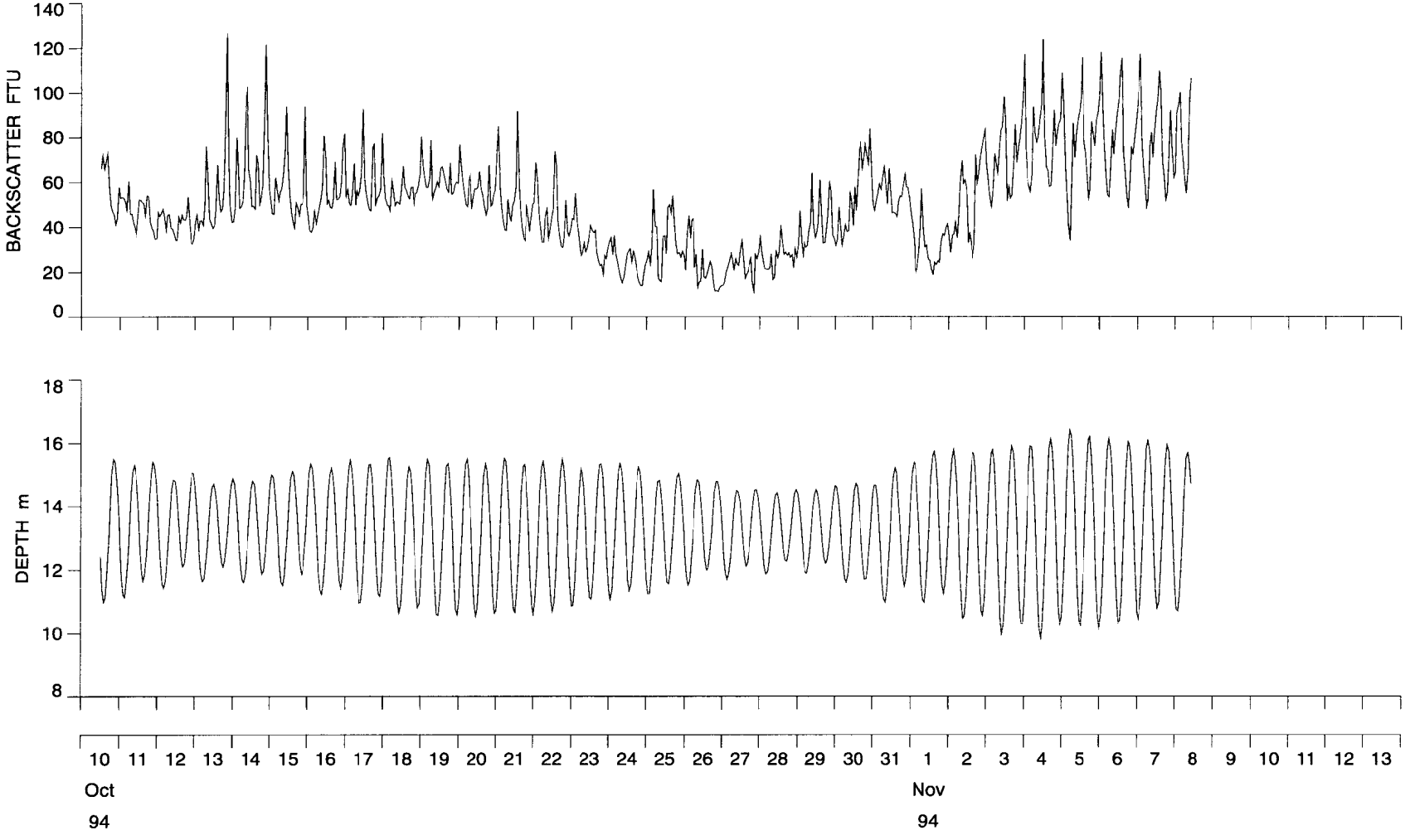


DEPTH AND OPTICAL BACKSCATTER TIME SERIES PLOTS

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m

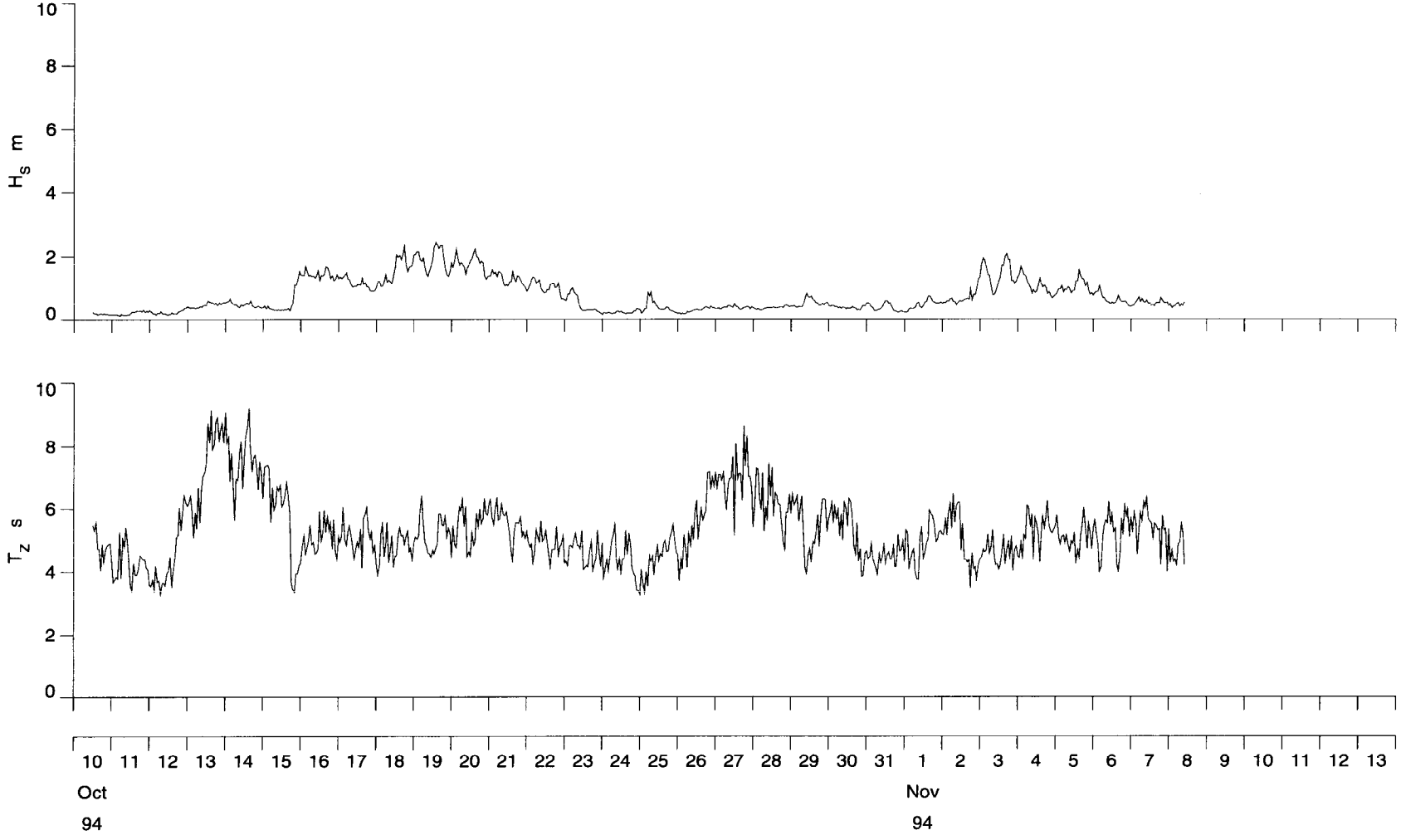


SIGNIFICANT WAVE HEIGHT AND ZERO UP-CROSSING PERIOD TIME SERIES PLOTS

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m

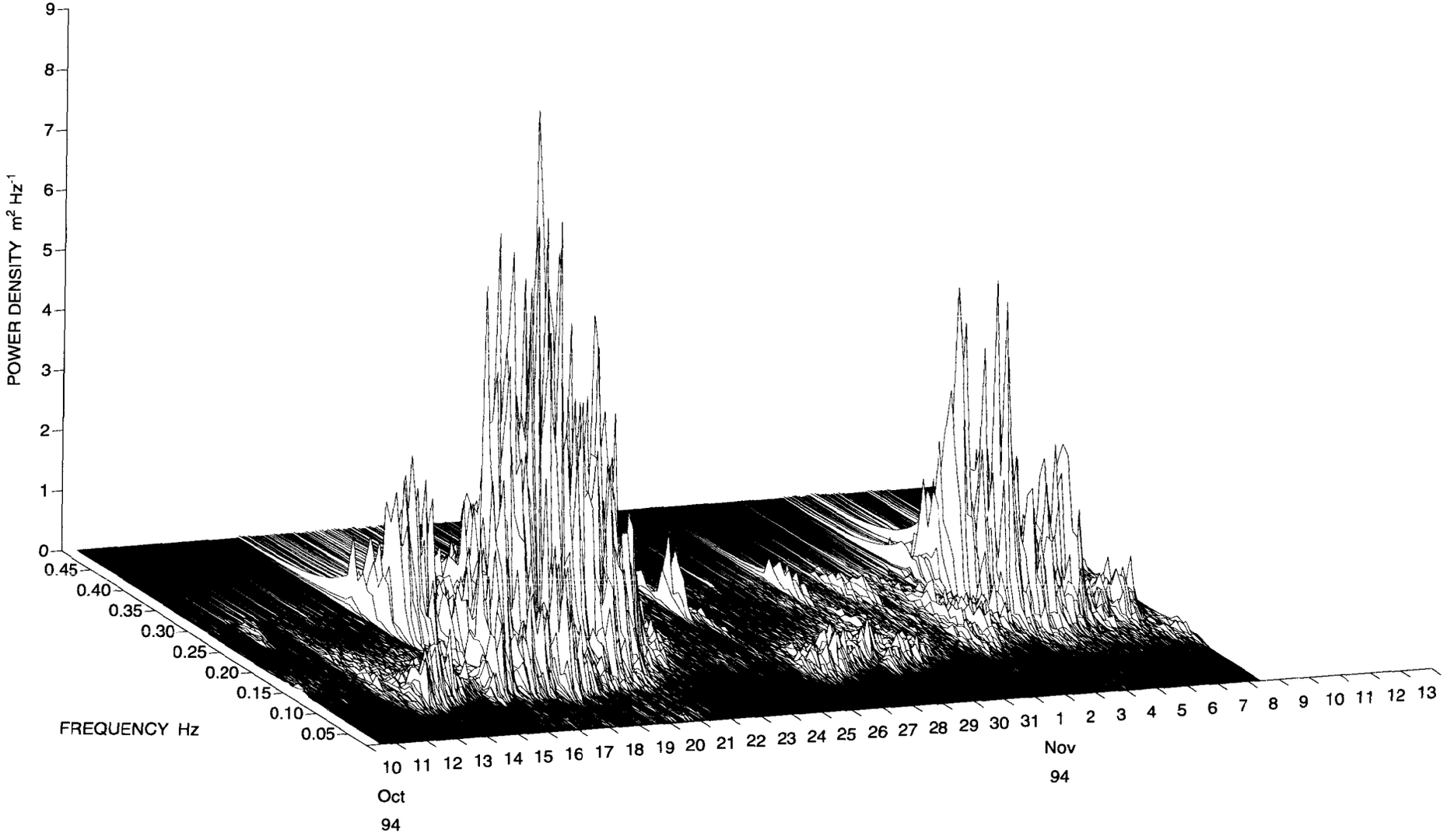


POWER DENSITY SPECTRA

Meter no. 2005 Rig no. 00643 Depth of water 14.0 m

Start/End 1994/10/10 AT 12:00:00 1994/11/08 AT 10:20:00

Position 53 42.62N 0 04.69E Meter Height 0.8 m



Statistics for s42005a.00643

	Mean	Variance	Standard deviation
Eastings	0.0896	2.913237E-02	1.706821E-01
Northings	-0.0439	7.974353E-02	2.823890E-01
Speeds	0.2993	2.926617E-02	1.710736E-01
Vector mean speed	0.0997		
Vector mean direction	116.1		

Maximum ten values

Eastings					Northings				
0.473	0.460	0.445	0.437	0.437	0.461	0.453	0.449	0.447	0.446
0.436	0.432	0.430	0.425	0.425	0.443	0.439	0.438	0.435	0.433

Minimum ten values

Eastings					Northings				
-0.186	-0.184	-0.184	-0.182	-0.179	-0.624	-0.623	-0.602	-0.588	-0.587
-0.175	-0.174	-0.171	-0.170	-0.169	-0.572	-0.565	-0.564	-0.563	-0.556

Maximum speeds

0.782	0.775	0.748	0.733	0.728	0.714	0.708	0.706	0.706	0.705
0.697	0.691	0.681	0.677	0.675	0.668	0.656	0.656	0.649	0.647
0.638	0.636	0.636	0.633	0.629	0.623	0.623	0.620	0.613	0.609
0.608	0.603	0.599	0.594	0.592	0.592	0.591	0.585	0.584	0.583
0.582	0.580	0.579	0.579	0.576	0.575	0.575	0.572	0.569	0.568
0.567	0.564	0.563	0.562	0.557	0.557	0.557	0.556	0.555	0.554
0.554	0.553	0.550	0.545	0.544	0.542	0.540	0.539	0.538	0.538
0.537	0.537	0.535	0.533	0.531	0.531	0.528	0.526	0.523	0.523
0.522	0.522	0.521	0.520	0.515	0.513	0.510	0.506	0.502	0.502
0.500	0.499	0.498	0.497	0.497	0.496	0.496	0.493	0.493	0.492

Variance ellipse statistics

Maximum variance	1.0879E-01	Direction	328.9
Minimum variance	2.4441E-04	Direction	58.9
Total variance	1.0903E-01	Ratio of variances	2.2466E-03
Average direction, maxdir - 90.0 to maxdir + 90.0	347.6		
Average direction, maxdir + 90.0 to maxdir - 90.0	135.1		

Mooring information for 00716

Position Latitude	: 53 47.60N
Position Longitude	: 0 03.49E
Water depth	: 19.0 m
Deployed on cruise	: FV Janet M (H5)
Site identification	: N2A
Magnetic variation	: 4.0 degrees west
Mooring deployed on	: 31-OCT-1995 15:27:00
Mooring recovered on	: 20-NOV-1995 15:30:00
Period of deployment	: 20.0 days
Comments	: None

Meter information for 0001

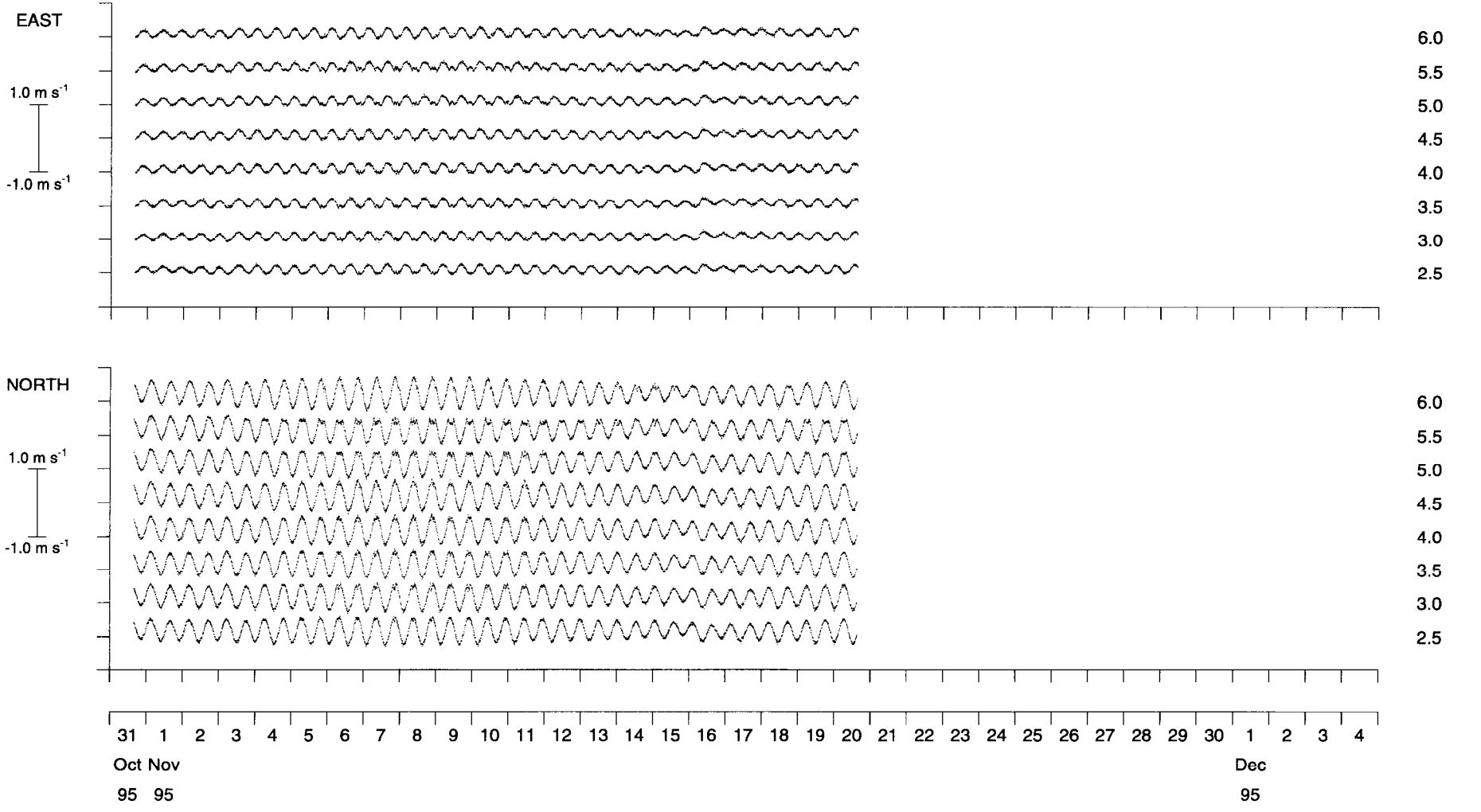
Mooring number	: 00716
Recording interval	: 600 s
Meter height from bottom	: 0.5 m
Meter type	: ADCP
Base, gap height	: 2.5 m, 0.5 m
Number of bins	: 22 of 26
Meter started	: 31-OCT-1995 15:40:00
Meter stopped	: 20-NOV-1995 15:30:00
Period switched on	: 20.0 days
Period of good data	: 20.0 days
Number of scans	: 2878
Timing error	: None
Comments	: None

VELOCITY COMPONENT TIME SERIES PLOT

Meter no. 0001 Rig no. 00716 Depth of water 19.0 m

Start/End 1995/10/31 AT 15:40:00 1995/11/20 AT 15:30:00

Position 53 47.60N 0 03.49E Base Ht 2.50 m Gap Ht 0.50 m

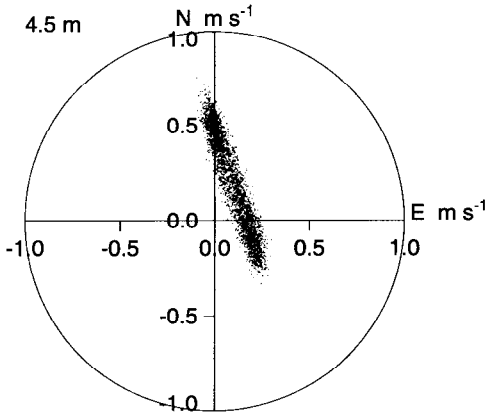


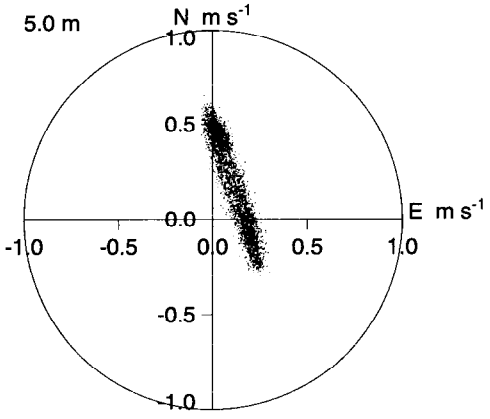
SCATTER PLOT

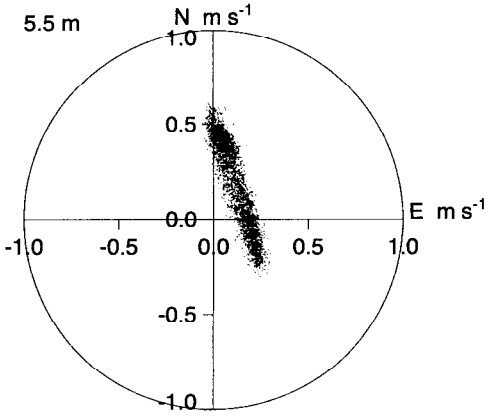
Meter no. 0001 Rig no. 00716 Depth of water 19.0 m

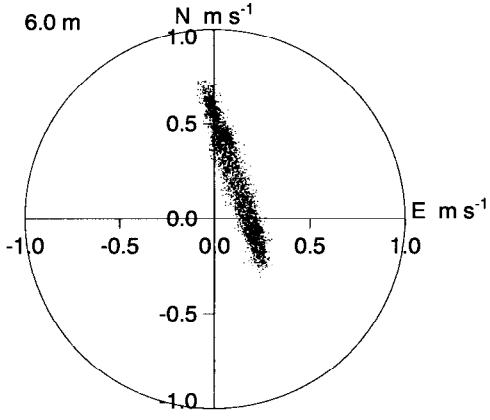
Start/End 1995/10/31 AT 15:40:00 1995/11/20 AT 15:30:00

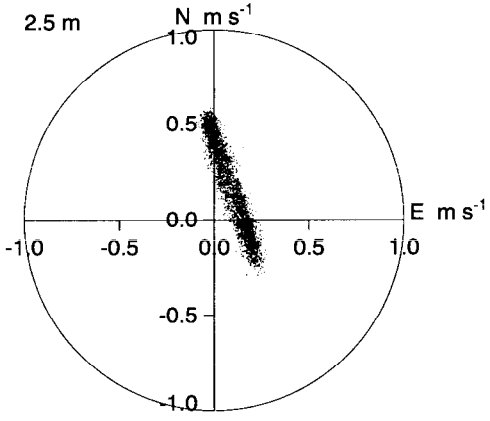
Position 53 47.60N 0 03.49E Base Ht 2.50 m Gap Ht 0.50 m

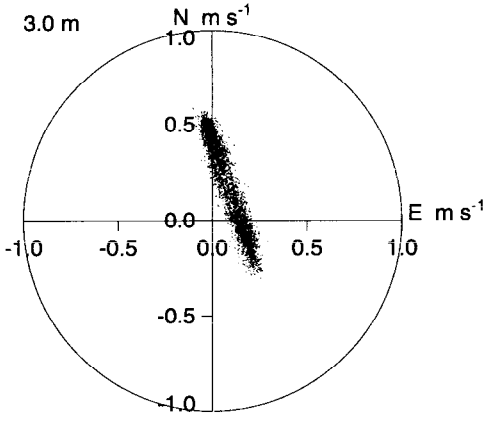


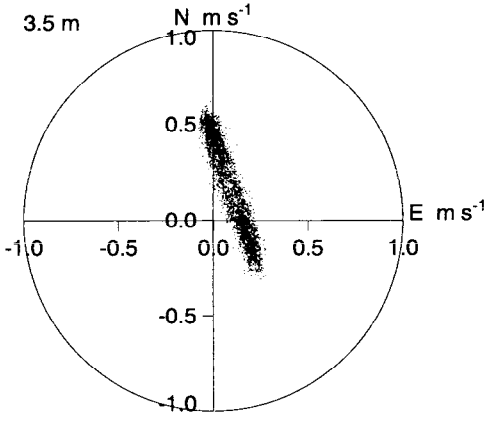


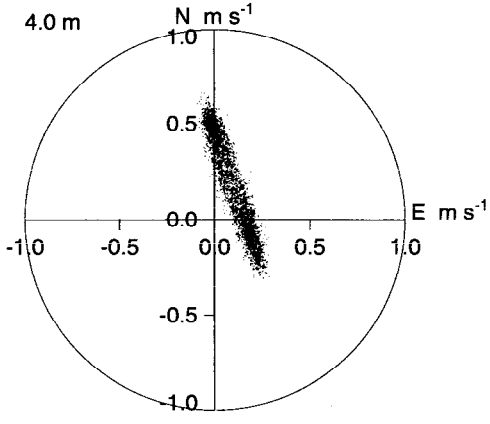










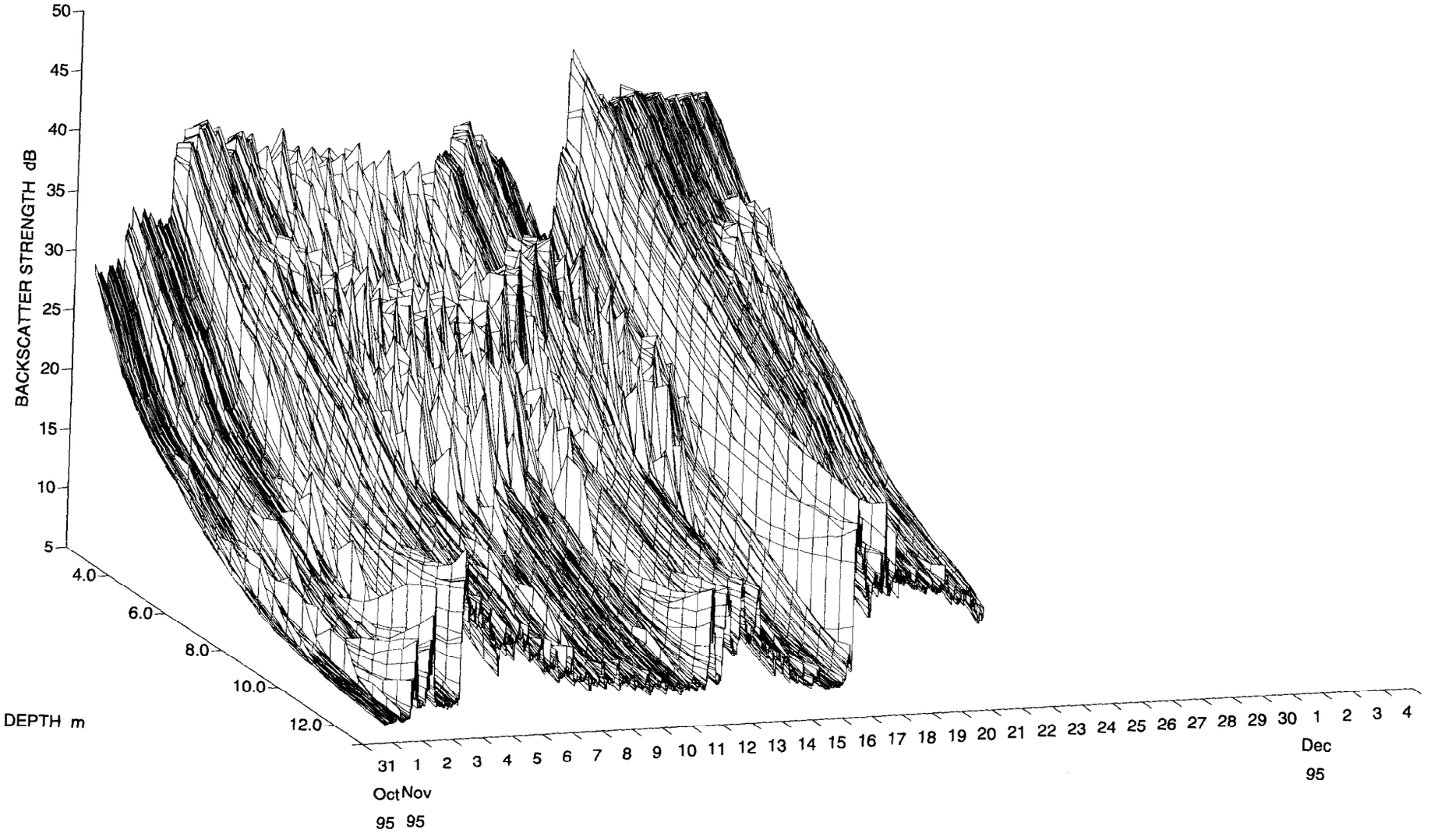


RELATIVE BACKSCATTER STRENGTH

Meter no. 0001 Rig no. 00716 Depth of water 19.0 m

Start/End 1995/10/31 AT 15:40:00 1995/11/20 AT 15:30:00

Position 53 47.60N 0 03.49E Base Ht 2.50 m Gap Ht 0.50 m



Statistics for dp0001.00716

Statistics for all good bins

ADCP Bin Number	ADCP Bin Height	Vector Mean Speed	Vector Mean Direction	Maximum Variance	Direction of Maximum Variance	Minimum Variance	Direction of Minimum Variance
1	2.5	0.191	27.6	0.0579	340.4	0.0008	70.4
2	3.0	0.190	27.4	0.0598	340.7	0.0008	70.7
3	3.5	0.196	27.7	0.0637	341.0	0.0009	71.0
4	4.0	0.207	27.0	0.0679	341.2	0.0009	71.2
5	4.5	0.220	26.0	0.0724	341.4	0.0009	71.4
6	5.0	0.221	28.5	0.0647	341.9	0.0009	71.9
7	5.5	0.221	31.3	0.0581	342.4	0.0010	72.4
8	6.0	0.241	26.4	0.0740	342.0	0.0009	72.0
9	6.5	0.251	25.5	0.0769	342.2	0.0009	72.2
10	7.0	0.262	24.5	0.0799	342.0	0.0009	72.0
11	7.5	0.271	24.1	0.0796	342.3	0.0009	72.3
12	8.0	0.278	23.7	0.0787	342.3	0.0009	72.3
13	8.5	0.282	23.6	0.0765	342.5	0.0009	72.5
14	9.0	0.285	23.5	0.0744	342.6	0.0009	72.6
15	9.5	0.288	23.6	0.0715	342.7	0.0010	72.7
16	10.0	0.290	23.6	0.0678	342.9	0.0011	72.9
17	10.5	0.291	23.7	0.0646	343.2	0.0013	73.2
18	11.0	0.291	23.5	0.0605	343.4	0.0014	73.4
19	11.5	0.287	23.7	0.0566	343.8	0.0017	73.8
20	12.0	0.284	23.8	0.0523	344.3	0.0020	74.3
21	12.5	0.280	23.9	0.0483	344.9	0.0023	74.9
22	13.0	0.276	24.0	0.0449	345.7	0.0027	75.7

Mooring information for 00728

Position Latitude	: 53 43.87N
Position Longitude	: 0 07.66E
Water depth	: 18.0 m
Deployed on cruise	: FV Janet M (H7)
Site identification	: S2
Magnetic variation	: 4.0 degrees west
Mooring deployed on	: 09-DEC-1995 12:25:00
Mooring recovered on	: 17-JAN-1996 12:10:00
Period of deployment	: 39.0 days
Comments	: None

Meter information for 1059

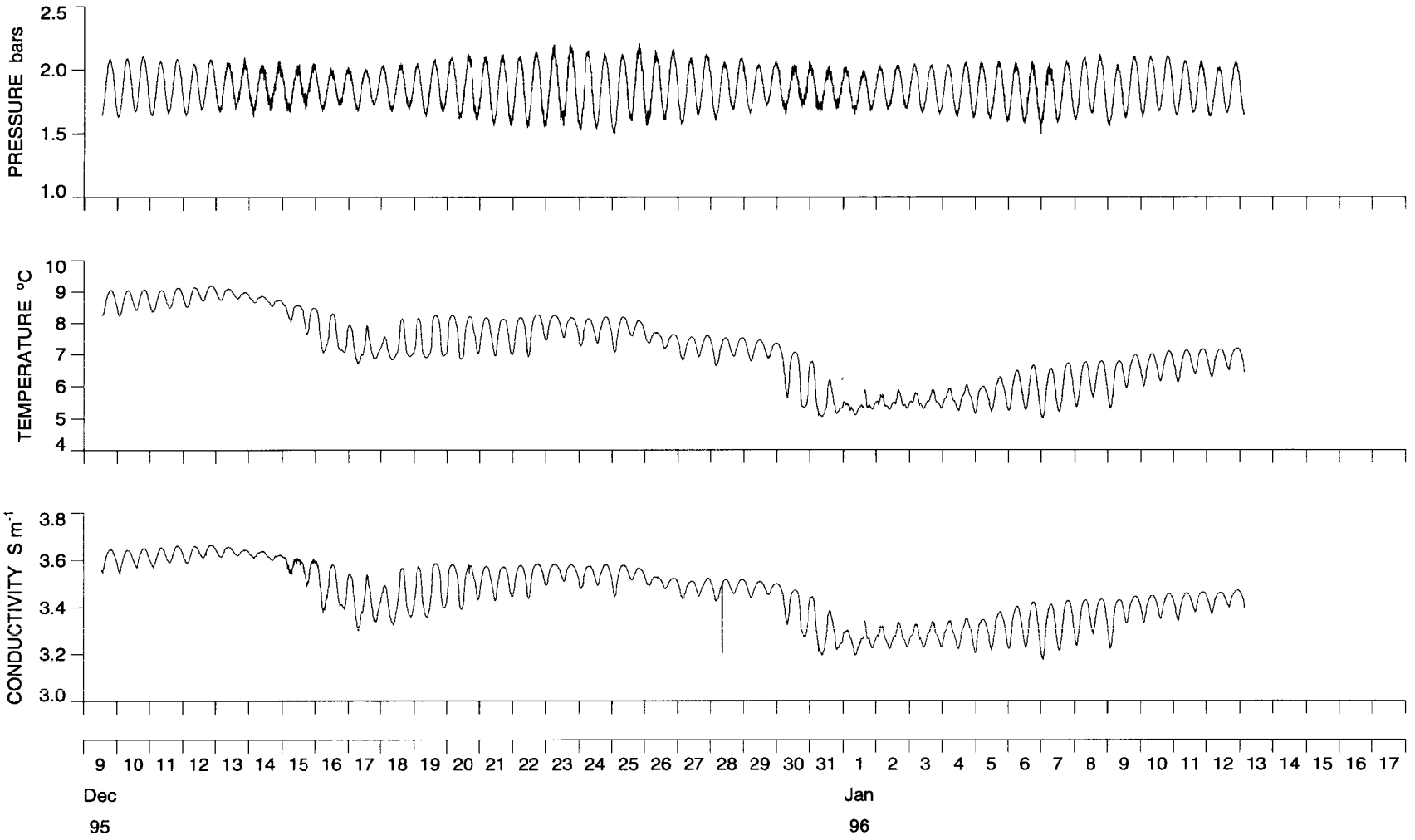
Mooring number	: 00728
Recording interval	: 600 s
Meter height from bottom	: 0.5 m
Meter type	: EMP
Meter started	: 09-DEC-1995 12:34:44
Meter stopped	: 13-JAN-1996 03:24:44
Period switched on	: 34.6 days
Period of good data	: 34.6 days
Number of scans	: 4986
Timing error	: None
Comments	: Time series truncated

PRESSURE, TEMPERATURE AND CONDUCTIVITY TIME SERIES PLOTS

Meter no. 1059 Rig no. 00728 Depth of water 18.0 m

Start/End 1995/12/09 AT 12:34:44 1996/01/13 AT 03:24:44

Position 53 43.87N 0 07.66E Meter Ht 0.5 m



OPTICAL BACKSCATTER STRENGTH AND pH TIME SERIES PLOTS

Meter no. 1059 Rig no. 00728 Depth of water 18.0 m

Start/End 1995/12/09 AT 12:34:44 1996/01/13 AT 03:24:44

Position 53 43.87N 0 07.66E Meter Ht 0.5 m